THE VULNERABILITY OF ADOLESCENTS PARTICIPATING IN RUGBY AND FOOTBALL IN DUBAI, UAE, TO EXERTIONAL HEAT ILLNESS

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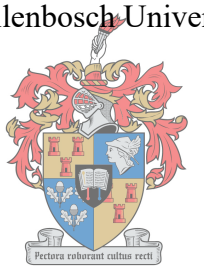

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March 2018

Declaration

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Abstract

Background

Regular appropriate physical activity for children and adolescents are needed to improve and maintain health. There are several risk factors for developing exertional heat illness (EHI), which negatively affect the thermoregulatory ability of the body, resulting in increased core body temperature. Exercising in high environmental temperatures and humidity increase the risk for EHI. Dubai, UAE, experience these environmental conditions. EHI presents as symptoms ranging from exercise associated muscle cramps, heat syncope and exercise related collapse, heat exhaustion, and exertional heat stroke. In the USA, exertional heat stroke is the leading cause of death in young athletes.

Objective

To determine the vulnerability of adolescent union rugby and football participants in terms of risk factors present for EHI, self-reported EHI symptoms and the hydration practices of the participants for the duration of the study.

Methods

A cross-sectional, descriptive design was used to address the research questions. The study was conducted at clubs offering union rugby or football in the Middle Eastern city of Dubai, UAE. Population sampling was applied, which included adolescents, aged between 10 -19 years old. The study occurred during a single training session at the start of the 2015/2016 season, during the month of October 2015. A questionnaire was used to elicit responses from the participants to measure self-reported risk factors, symptoms of EHI and hydration practices.

Results

A response rate of 22.4% (n= 111) was obtained, 49 union rugby and 62 football participants were recruited from a total of 500 players that initially attended the information session. The main findings of the study include: 19 % (n=21) of participants self-reported EHI risk factors; 14.4% (n= 16) of participants' self-reported exercises-associated muscles cramps, which was the only EHI symptom category, and 10.8% (n= 12) of participants did not report any EHI symptom. Fluid was consumed by 94.5% (n= 105) before training, 100% (n= 111) during training, and 100% after training. Water was the most abundant fluid consumed before (86%, n= 91), during (94.5%, n=

105) or after (55%, n= 61) training. Many participants (77.5%, n= 86) indicated that they are knowledgeable if they consumed too much fluid. Beside fluid provided by the two football clubs, no other side-line support measures were noted. Poorer general physical fitness was associated with more EHI symptoms (*rho* = -0.211, *p* = .026). An additional significant association was found between the number of EHI risk factors and the fluid intake volume after practice, with higher intake being associated with more symptoms (*rho* = 0.197, *p* = .043). In those participants who reported generally better physical fitness (*rho* = -0.206, *p* = .030), significantly fewer EHI symptoms were noted. For those participants who reported consuming more fluids before practice (*rho* = 0.313, *p* = .001), and consuming fluids a longer time prior to practice (*rho* = 0.253, *p* = .009), the number of EHI symptoms were significantly greater. There were no significant associations between self-reported EHI risk factors (any vs. none) with self-reported EHI symptoms (any vs. none).

Conclusion

The findings imply that slightly less than one in five participants were vulnerable to develop EHI in this sample of adolescents in the UAE. No significant association was demonstrated between self-reported EHI risk factors and self-reported EHI symptoms. This correlates to current disagreement on ability to identify those at risk for development of EHI. Amateur clubs lack adequate preparation to prevent, recognise and treat severe EHI episodes, which was demonstrated through the lack of any available emergency action plans. The self-reported hydration practices suggested that the participants did consume sufficient fluids.

Opsomming

Inleiding

Daar is verskeie risiko faktore vir die ontwikkeling van oefenings-geassosieerde hittesiekte (OGH), wat 'n negatiewe invloed op die temperatuur regulasie vermoë van die liggaam het, en wat dan lei tot verhoogde kern liggaam's temperatuur. OGH vertoon simptome wat wissel van oefeninge-verwante spierkrampe, hittesinkopee en oefening-verwante ineenstorting, hitte-uitputting, en oefening-geassosieerde hitte ontsteek.

Oogmerk

Die studie is uitgevoer om die kwesbaarheid van adolessente, unie rugby en sokker, spelers te bepaal in terme van self-gerapporteerde risiko faktore, OGH-simptome teenwoordig en die hidrasie praktyke, te bepaal.

Metodologie

Die studie is uitgevoer by verskeie klubs wat unie rugby of sokker aanbied in Dubai, VAE. Die studie het plaasgevind tydens 'n enkele oefensessie aan die begin van die 2015/2016 seisoen, gedurende Oktober 2015. 'n Deursnee-, beskrywende metode was gebruik om die navorsingsvrae te beantwoord. Bevolking-steekproefneming was toegepas, adolessente tussen 10 -19 jaar oud is ingesluit. 'n Vraelys is gebruik om antwoorde van die deelnemers te kry sodat self-gerapporteerde risikofaktore, simptome van OGH en hidrasie praktyke bepaal kon word.

Resultate

Die belangrikste bevindinge van die studie is die volgende: 19% (n= 21) van die deelnemers het self-gerapporteerde OGH risiko faktore; 14.4% (n= 16) van die deelnemers het self-gerapporteerde oefeningsverwante spierkrampe, wat die enigste OGH simptoomkategorie wat getoon was, en 10.8% (n= 12) van die deelnemers het geen OGH simptoome gerapporteer nie. Vloeistof was deur 94.5% (n = 105) deelnemers voor oefeninge, 100% (n = 111) tydens oefeninge, en 100% na oefeninge ingeneem. Water was die vloeistof wat die meeste voor (86%, n = 91), tydens (94.4%, n = 105) of ná (55%, n = 61) eofeninge gebruik is. Baie deelnemers (77,5%, n = 86) het aangedui dat hulle kundig is indien hulle te veel vloeistof gebruik. Geen ander kantlyn ondersteunings materiaal, behalwe vloeistof wat deur beide sokkerklubs voorsien was, is opgemerk nie. Die swakste algemene fisiese fiksheid is geassosieer met meer OGH-simptome (*rho = -0,211, p = 0,026*). 'n Bykomende beduidende assosiasie is gevind tussen die aantal OGH risikofaktore en die

volume van vloeistof in geneem na die oefen sessie, met ’n hoër inname wat verband hou met meer simptome (*rho = 0,197, p = 0,043*). By daardie deelnemers wat oor die algemeen beter fisiese fiksheid angedui het (*rho = -0,206, p = 0,030*), is aansienlik minder OGH simptome opgemerk. Vir diegene wat gerapporteer het dat hulle meer vloeistof voor oefeningsessie (*rho = 0,313, p = 0,001*), en vir ’n langer tydsduur voor ’n oefen sessie (*rho = 0,253, p = 0,009*), die aantal OGH simptome aansienlik meer.

Gevolgtrekking

Die bevindinge impliseer dat effens minder as een uit elke vyf deelnemers vatbaar om OGH te ontwikkel uit hierdie bevolking van adolessente in VAE. Amateur klubs is nie voldoende voorbereid om ernstige OGH-episodes te verhoed, te identifiseer en te behandel nie, soos gedemonstreer deur die gebrek aan enige nood aksie planne. Die self-gerapporteerde hidrasie praktyke het daarop gedui dat die deelnemers voldoende vloeistowwe gedrink het , maar nie altyd volgens aanbevole riglyne nie.

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Terminology

Vulnerability: Susceptibility to injury

Adolescent: Young person between the ages of 10-19

Exertional Heat Illness: "Severe heat illness induced by strenuous exercise, often occurring in a hot environment that causes the thermoregulatory system to overload"

Exertional Heat Stroke: "The accompaniment of signs and symptoms of organ system failure, central nervous system dysfunction, together with a rectal temperature above 40˚C"

Hydration: Consumption or absorption of water or sports drinks into the body

Dehydration: A dynamic loss of body water or the transition from euhydration to hypohydration

Heat-acclimatisation: A complex series of changes or adaptations that occur in response to heat stress in a controlled environment over the course of 7 to 14 days. These adaptations are beneficial to exercise in the heat and allow the body to better cope with heat stress.

Sudden death: Death that occurs unexpectedly and from 1 to 24 hours after the onset of symptoms, with or without known pre-existing conditions

Emergency action plan: Protocols or procedures to follow by pre-designated personnel in the case of a medical emergency, within EHI, EHS is a medical emergency

Union rugby: A football game in which play is continuous without time-outs or substitutions, interference and forward passing are not permitted, and kicking, dribbling, lateral passing, and tackling are featured

Football: A form of football played between two teams of 11 players, in which the ball may be advanced by kicking or by bouncing it off any part of the body but the arms and hands, except in the case of the goalkeepers, who may use their hands to catch, carry, throw, or stop the ball.

Hydration practices: The routine or not of what, how much and when players drink fluids

Self-perceived fitness: A self-determined perception of an individual's own fitness levels without the use of laboratory tests

Obesity: A measure of excess body fatness

Wet bulb globe temperature: A composite temperature used to estimate the effect of temperature, humidity, wind speed (wind chill), and visible and infrared radiation (usually sunlight) on humans. It is used by industrial hygienists, athletes, and the military to determine appropriate exposure levels to high temperatures.

Morbidity and Mortality as referred to in EHI: The life threatening consequences of poor treatment of EHS, resulting in organ failure and possible death; are directly related to the duration of core temperature elevation and appropriate treatment

Certified Athletic Trainers: Health care professionals who collaborate with physicians. The services provided comprise prevention, emergency care, clinical diagnosis, therapeutic intervention and rehabilitation of injuries and medical conditions

Volunteers for rugby: a person, with or without medical background, whom have received at least Basic Life Support (BLS) training, providing first-aid support during training or games; cannot provide treatment outside of that which was covered during BLS training**.**

Chapter 1: Introduction

This chapter will provide a background to the importance of why this study is needed, the problem statement and the research question. The aim(s) and objectives, as well as purpose of the study will be described.

1.1 Background

The range of benefits associated with regular physical activity include improved strength and endurance, healthy bones and muscles, weight control, reduced anxiety, and stress, and increased self-esteem (US Dept. Health and Human Services, 2008). Regular appropriate physical activity for children and adolescents are needed to improve and maintain health (American Academy of Paediatrics, 2011).

A positive trend, in USA, is a steady increase in the number of high school athletes over the past four years. The United States saw a 1.058% increase from 2012 to 2014, which represents over 7 million athletes from different sports codes (National Federation of State High School Associations, United States, 2014). An increase from 2.8 million to 3.2 million rugby players was noted in 2016 (World Rugby, 2017). In football an increase of 7% was observed from 2000 to 2006 (Kunz, 2007). Unfortunately official number for UAE is not available, but rather numbers for players registered in rugby and none for football. Therefore the possibility exist that more athletes (as result of increased participation) might experience an injury if considering the various risks associated with various sports.

All sports carry inherent (intrinsic and extrinsic) risks for injury, irrespective of participation level (Murphy, Connolly, & Beynnon, 2003). Among these risks is an increased risk to develop exertional heat illness (EHI) when exercising in hot and humid conditions (Armstrong, 2003). The environmental risk factors (high temperatures and humidity) are present in Dubai, UAE, (Government UAE, 2015) at the start of the union rugby and football season during September of each year. Acclimatisation is suggested to specific (American College of Sport Medicine, 2007). As noted through personal experience of the primary investigator, numerous sports players in this age group leave Dubai at the end of June (end of school year) and return at the end of August (start of new school year). These players are thus unlikely to be acclimatised to the conditions during the start of the season (Carrel, Clark, Peterson, Eickhoff & Allen, 2007). There are numerous risk factors for

development of EHI (American College of Sport Medicine, 2007; National Athletic Trainers Association, 2000; National Athletic Trainers Association, 2002), and there are no known differences in these risk factors between adolescent or adult athletes (Kerr et al., 2013; Cleary 2007). Exertional heat illness causes a thermoregulatory system overload (Kerr, Casa, Marshall & Comstock, 2013) presenting as symptoms ranging from exercise-associated muscle cramps (EAMC), heat syncope and exercise-related collapse, heat exhaustion, and exertional heat stroke (EHS) (American College of Sport Medicine, 2007; National Athletic Trainers Association, 2002; World Health Organisation, 2010).

EHI can result in a withdrawal from activity or collapse during or soon after activity (American College of Sport Medicine, 2007). Most research is done in the USA (Mao et al., 2016), where EHI is noted to be the leading cause of death in youth athletes (Doerer, Maron, Haas, Tierny & Mueller, 2009; Burgeron, et al., 2005). It is further considered that EHI is 100% preventable (Boden, Breit, Beachler, Williams and Mueller, 2013) and outcomes improve when appropriate treatment is instituted (American College of Sport Medicine, 2007; Sithinamsuwan, et al., 2009). However, in Dubai, the Dubai Health Authority does not record EHS as a cause of death and the number of sports clubs in Dubai would suggest that some EHI does occur. This lack of reporting does not inform of either the incidence or prevalence of EHI. It further limits those involved in how to prepare to address EHI.

Best practice recommendation for the reduction of sudden death, during collegiate and secondary schools' (USA) sports conditioning sessions (including as result of EHI), was developed by the Inter-Association Task Force (Oded, 2003). Numerous other organisations also present recommendations in the management of exertional heat illness, e.g. American College of Sport Medicine, 2007; National Athletic Trainers Association, 2015; National Athletic Trainers Association, 2002, International Olympic Committee, 2012. There is currently no literature available on EHI, within the Middle Eastern adolescent age group. Literature form the Israeli Military by Rav-Acha, Hadad, Epstein, Heled, and Moran (2004) suggest that educational programs regarding EHI are needed to increase the awareness of medical staff and commanders.

First-aid volunteers, with no specific background knowledge of EHI, are used in union rugby and football. In union rugby and football clubs, players are grouped within specific age groups, rather than ability. In Dubai, the players practice in an outdoor environment on either artificial or natural

turf. The variability in the ability of the payers grouped into same age group can result in weaker players training at a more intense level. Together with the environment, these two factors can lead to increased risk for development of exertional heat illness.

With no reporting of EHI in Dubai which does not inform us of the incidence or not, warrants the investigation of whether or not EHI does actually occur in Dubai. Does this reflect a lack of knowledge in assessing for EHI or is this a lack of awareness about EHI? Considering the risk factors, all of which are evident in Dubai, at least some cases of EHI should be present. Therefore, determining the vulnerability of youth athletes to EHI could be a start in order to possibly raise awareness of this condition in Dubai.

1.2 Problem statement

There are no available incidence or prevalence rates of EHI in Dubai or the Middle East. Information as to the readiness or not of local amateur sports clubs to manage EHI, and especially the more severe form of EHS is unknown. Considering the mortality and morbidity associated with EHS, it is imperative that those involved with adolescent sports be educated and sufficiently prepared to deal with incidents.

1.3 Research Question

How vulnerable are adolescent union rugby or football players to the development of EHI, in Dubai UAE?

1.4 Aim of the Investigation

To determine the vulnerability of adolescent sport's participants which practice union rugby and or football to exertional heat illness (EHI) in Dubai, UAE, in order demonstrate the need to implement appropriate management or educational strategies.

1.5 Objectives

The objectives are to describe

- Self-reported symptoms of EHI and

- Selected risk factors (hydration practice, self-perceived fitness, obesity, pre-existing health conditions and medications, as well as sideline support during training or games) among adolescent sports participants in Dubai.

1.6 Significance of the study

To highlight the need for sufficient medical planning (prevention, assessment and management) concerning EHI in Dubai, UAE, specifically referring to union rugby and football players. The planning will allow club administrators to ensure that they provide as safe an environment as possible for players to enjoy the sport. There will be further benefit to coaches in that they will have players that train regularly, which most probably result in improved skill and thus performance. The medical personnel or volunteers will know that they are prepared, through educational and training sessions, to address incident if this occur.

Chapter 2: Literature Overview

2.1 Introduction

The aim of the review was to identify literature concerning the management of exertional heat illness (EHI) within the adolescent sporting population participating in training or games under hot and humid environmental conditions, is presented in this chapter. The approach to manage exertional heat illness consists of preventative measures, assessment or recognition of symptoms and treatment options. Definitions of EHI are also reviewed. Literature pertaining to populations most affected and the outcomes associated with exertional heat illness are explored.

The layout of this chapter is as follow: The literature search methodology, to identify the considered impact on adolescent population. The management recommendations of what is currently advised and or to identify any discrepancies noted. Implementation of recommendations in order to identify who is involved this process. Noting if any differences exist in the definition(s) associated with EHI. Identify the prevalence or incidence of EHI among adolescents in order to establish the significance or not in this population group. The identification of risk factors associated with EHI. To highlight the outcomes associated with EHI. Describe the recommendations in terms of prevention, assessment and management options for EHI. Highlighting the Middle Eastern context in order to demonstrate what is known or unknown within the geographical area.

2.2 Literature search add methodology

The literature search covered the management of EHI, focused on the identification of recommendations or consensus statements regarding EHI management in hot and humid environments. Management is considered to included prevention, assessment and treatment (National Athletics Trainers Association, 2015; American College of Sport Medicine, 2007).

The primary investigator searched 13 guideline clearing houses: - The US National Guideline Clearinghouse (US NGC); Agency for Healthcare Research and Quality (AHRQ), Guidelines International Network (G-I-N), Scottish Intercollegiate Guidelines (SIGN), United Kingdom's National Institute for Health and Clinical Excellence (NICE), New Zealand guidelines group

(NZGG), WHO guidelines, TRIP database, National Institutes of Health (NIH), Monash University Centre for Clinical Effectiveness, Canadian Medical Association Clinical Practice Guidelines Infobase, Institute for Clinical Systems Improvement (ISCI), and Cochrane, 9 electronic databases, namely -PubMed, Web of Sciences, CINAHL, EBSCO host, Medline, SAGE, SportDiscus, ArticleFirst, ProQuest – were also searched for publication from January 2000 to November 2015 to ensure current up to date information.

This search was executed between July 2015 and March 2016. Search terms used included: exertional heat illness, or heat illness or heat stroke, AND adolescents sports participants or youth sports athletes, AND clinical practice guidelines or guidelines or care pathways or protocols or recommendations AND prevention or risk factors, AND assessment or identification or evaluation, AND management or treatment. The search was limited to the English language. Details about the full search results are available in Appendix M

The above mentioned databases were further searched for definitions of exertional heat illness, individuals or groups most affected and the outcomes noted following a diagnosis of exertional heat illness. Search terms included: exertional heat illness, or heat illness or heat stroke AND populations affected or groups concerned AND outcomes or results or consequences.

2.3 Management recommendations for EHI

The management recommendations from the articles reviewed (Appendix N) included all categories of exertional heat illness, which are exercise-associated muscle cramps (EAMC), exercise-related heat syncope, heat exhaustion and exertional heat stroke (EHS). However, in three articles the recommendations for only EHS were presented.

The different aspects of management, within the included recommendations (Appendix N) have various forms of evidence to support these recommendations. Support evidence in the form of reference to research for some of the recommendations by American Academy of Paediatrics (2011), and research reference for other (not mentioned below) recommendations within the articles were included (Appendix N). Strength of Recommendation Taxonomy (SORT) is used in recommendation articles by National Athletics Trainers Association (2015) and National Athletics Trainers Association (2012), while recommendation by American College of Sport Medicine

(2007) describe support evidence similar to SORT, but not referenced. The American College of Chest Physicians evidence grading was used for recommendations by Lipman et al., (2014) and the recommendation article by Olympia and Brady (2013) referred to recommendation article of National Athletics Trainers Association (2012). A description of SORT (Table 2.1) and ACCP (Table 2.2) can be viewed below.

Table 2.1: Strength of recommendation [SORT]

Category	Description
A	Recommendations based on consistent and good quality patient-orientated evidence
B	Recommendations based on consistent or limited quality patient-orientated evidence
C	Recommendations based on consensus, usual practice, opinion, disease-orientated evidence or case series for studies of diagnosis, treatment, prevention or screening

Table 2.2: American College of Chest Physicians Grading System (modified from ACCP, 1996)

Grade of recommendation/ description	Implications
1A/strong recommendation, high-quality evidence	Strong recommendation, can apply to most patients in most circumstances without reservation
1B/strong recommendation, moderate quality evidence	Strong recommendation, can apply to most patients in most circumstances without reservation
1C/strong recommendation, low-quality or very low quality evidence	Strong recommendation but may change when higher quality evidence becomes available
2A/weak recommendation, high quality evidence	Weak recommendation, best action may differ depending on circumstances or patients' or societal values
2B/weak recommendation, moderate-quality evidence	Weak recommendation, best action may differ depending on circumstances or patients' or societal values
2C/weak recommendation, low quality or very low-quality evidence	Very weak recommendations; other alternatives may be equally reasonable

There is also disagreement (Joslin, Mularella, & Worthing, 2014) regarding the terms used to define EHI, leading to differences in overall management. The main concern regarding management of EHI, is that, depending on the definition within the research, different management processes were advised. There are further disagreement (Joslin, et al., 2014) with supporting

evidence to suggest that either current guidelines or recommendations does not take into account updated research, or there is a lack of evidence to support some recommendations.

2.3.1 Recommendation implementation

Thus, regarding the implementation of recommendations, who should be responsible in an amateur environment? As most research has been done in the USA (Mao et al., 2016), National Athletics Trainers Association (2015) suggested specifically that certified athletic trainers (AT in USA) and other health care professionals use the information to implement these recommendations. In environments where the AT is not available, American Academy of Paediatrics (2011) suggests that paediatricians take this responsibility in advocating and implementing the recommendations. This does not, however, answer the question in the environment where the paediatrician does not have knowledge of the recommendations or is not involved within the sports community.

If considering the noted morbidity and mortality, a significant risk is involved with the responsibility of advocating and implementing the recommendations. Following this, the next question is how to mitigate these risk taken by a volunteer or does the amateur environment require a paid, medically trained professional to accept these risk? The amateur environment cannot afford medically trained professionals, thus athletes need to sign a waiver to protect the volunteer who advises and implements the recommendations.

2.4 EHI definitions

EHI is defined by Kerr et al. (2013) as “severe heat illness induced by strenuous exercise, often occurring in a hot environment that causes the thermoregulatory system to overload”. The overload of the thermoregulatory system presents as exercise-associated muscle cramps, heat syncope and exercise-related collapse, heat exhaustion, and EHS (American College of Sport Medicine, 2007; National Athletic Trainers Association, 2002, World Health Organisation, 2010).

EHS is defined as the accompaniment of signs and symptoms of organ system failure, central nervous system dysfunction, together with a rectal temperature above 40 °C (American College of Sport Medicine, 2007; National Athletic Trainers Association, 2002, World Health Organisation, 2010). However, Noakes (2008) recommended that only exertional heat stroke be classified as

EHI because EHS is a clinical entity with clearly identifiable signs and symptoms, with other categories being non-specific in the presentation of symptoms and signs.

Table 2.3: EHI symptom category and presentation

SYMPTOM	PRESENTATION
Exercise-associated muscle cramps	Acute, painful & involuntary muscle contraction
Heat syncope & exercise-related collapse	Inability to stand upright or walk independently as a result of light-headedness, more often at completion
Heat exhaustion	Inability to continue exercise associated with, normal CNS function, heavy sweating, pallor, "prickly heat" sensations, headaches, abdominal cramps, nausea, vomiting, diarrhoea, persistent muscle cramps
Exertional heat stroke	Collapsed, presence of CNS dysfunction,

2.4.1 EHI spectrum

Lipman et al. (2014) described forms of EHI as a spectrum of disease from hyperthermia, heat oedema, and heat cramps, to heat syncope followed by heat exhaustion and life-threatening heat stroke. The authors differentiated between classical and exertional heat illness, though they did not differentiate between presentations of classical or exertional heat illness. The authors further provide the pathophysiology of EHS only, without noting whether any differences existed between classic or exertional heat illnesses. Systemic inflammatory response syndrome (SIRS) is considered to be responsible for the pathophysiological response that ensues following heat-induced damage to the gut and other organs (Bouchama & Konchel, 2002). Endotoxin, which is normally confined to the lumen of this organ, after damage to the epithelial membrane of the gut, leaks into the systemic circulation and results in an immune response causing tissue injury (Leon, Blaha & DuBose, 2006). The thermoregulatory, immune, coagulation, and tissue injury responses observed during clinical sepsis are likely mediated by similar cellular mechanisms (Feterowski, et al., 2003). Bouchama (1995) suggested that there are differences between classical and exertional heat stroke, however an observational study, of 58 patients admitted to intensive care following the 1995 Chicago heat wave demonstrated system dysfunction similar to EHI (Dematte et al., 1998).

Joslin, et al. (2014) argued that EAMC (refer to Table 2.3) pathophysiology is not clearly understood, citing evidence by Maughan (1986) that demonstrated, in marathoners, that no difference in sodium, potassium and fluid losses existed between those who did and did not develop muscle cramps. Another theory is that EAMC results from neuromuscular fatigue and muscular overload (Schwellnus, Derman, & Noakes, 1997).

Joslin, et al., (2014) refuted the concept of heat syncope (refer to Table 2.3), - the transient loss of consciousness with spontaneous return to normal mentation as presented by Lipman, et al. (2014). Joslin, et al., (2014) considered Lipman et al.'s. (2014) heat syncope as correlating to exercise-associated collapse and referred to the description given by Noakes (2008) explaining the pathophysiology of exercises-associated collapse, which do not require heat stress as part of the process. Joslin, et al. (2014) argued that they did not support dehydration's role in the development of EHI as no reliable correlation existed to measurable hypohydration and weight loss.

2.5 Prevalence and incidence of EHI among adolescents

In the United States of America, EHI is among the leading causes of death in young athletes (Doerer et al., 2009; Burgeron et al., 2005). This leading cause of death might only be due to a larger number of youth athletes as compared to adult athletes (National Collegiate Athletic Association, 2013). Thermoregulation in prepubertal are considered to be more efficient, though the authors note that net metabolic heat production and heat gain were highest in prepubertal athletes compared to young adults and older males (Inbar, Morris, Epstein, & Gass, 2004). The Centers for Disease Control and Prevention (CDC, 2010) found that there was an increase in diagnosis of EHI in adolescents during 2005-2009, as calculated from the High School Sports Related Injury Surveillance Program, USA.

Increased morbidity and mortality was associated with EHS (American College of Sport Medicine, 2007; National Athletics Trainers Association, 2002; World Health Organisation International Classification of Disease, 2010). According to Boden et al., (2013) 100% of EHS is preventable. Kerr et el., (2013) noted that 20% of certified athletic trainers treated a case of EHS in 2011. During the period from 2005 – 2009, the highest number of deaths was reported at high school and college level in USA (Mueller & Colgate, 2012). There was a 135% increase in EHI reported from 1997 – 2006, with 75% occurring in sport for those treated in emergency rooms. A larger

proportion of patients aged up to 19 years sustained sport and recreational exertional heat related injuries (Nelson, Collins, Comstock & McKenzie, 2011).

During the period 1955-2005, more than 90 high school American football players died of EHI and three heat stroke deaths occurred in 2005 according to the National Centre for Catastrophic Sport Injury Research website (www.unc.edu/depts/nccsi). An incidence rate of -2.8:- 1000 player hours was reported during USA Cup Soccer tournament (Elias, 2001). Seventeen percent of the 121 medical events that were serious enough to remove the athlete from completing the event during the 1985 Junior Olympic Games in Iowa were due to exertional heat illness (Martin, Yesalis, Foster, & Albright, 1987)

Cater (2008) argued that the incidence rate in athletics cannot be calculated due to a lack of information provided in current research. Though American College of Sport Medicine (2007) provide incident rates for EHI, none are for adolescent athletes. There are no statistics available for other countries except the USA as other countries do not have injury surveillance programmes (Australian Clearing house for sport website, n.d.) that collate information.

2.6 Intrinsic and extrinsic risk factors for EHI

There are several risk factors for developing EHI, namely environmental heat stress, lack of heat acclimatisation, history of heat illness, dehydration, exercise intensity, poor physical fitness, obesity, overzealousness, illness resulting in dehydration and fever, predisposing medical conditions, and certain medication and drug use pertaining to EHI. (American College of Sport Medicine, 2007; National Athletics Trainers Association, 2000; National Athletics Trainers Association, 2002; National Athletics Trainers Association, 2015). There are no known differences in risk factors between adolescent or adult athletes (Kerr et al., 2013; Cleary, 2007). These risk factors negatively affect the thermoregulatory ability of the body, resulting in increased core body temperature and thus the possible development of EHI. Exertional heat illness occurs when thermoregulation fails, even in the young and active population (Inbar et al, 2004). Falk and Dotan (2008) and Rowland (2008) suggest that there are no differences in thermoregulation when training in the heat, between adults and children. Thermoregulation refers to a process by which the body maintain core temperature and is succinctly described by Lim, Byrne and Lee (2008) for athletes participating in heat conditions.

Table 2.4: Risk factors and considered justifications

Risk Factors	Considered justifications
Environmental heat stress	Individuals absorb heat when the environmental temperature is above skin temperature and evaporative heat loss is reduced with increased humidity, resulting in a possible rise of core body temperature. Sawka, Leon, Montain & Sonna, L.A, (2011); Casa et al (2012)
Lack of heat acclimatisation	Athletes have a reduced ability to cope with thermal stress. Pandolf (1998); Armstrong, L.E, & Maresh, C.M (1991)
Exercise intensity	A rapid rise in core temperature is produced by high-intensity exercises, which result in substantial metabolic heat production. Noakes TD, Myburgh KH, du Plessis J., Lang, L; Lambert, M., C. Van Der Riet, C. & R. Schall (1991)
Overzealousness	Athletes tend to ignore early warning signs and override behavioural adaptations. Cleary M. (2007)
Poor physical condition	Reduced aerobic power (VO_2 Max) reduces the ability to reduce heat stress. Wallace, R.F., Kriebel, D., Punnett, L., Wegman, D.H., Wenger, C.B, Gardner, J.W., & Kark, J.A. (2006)
Obesity	Obese athletes produce more metabolic heat and are less efficient in dissipating heat. Chung, N.K., Pin, C.H. (1996)
Dehydration	Thermoregulation and performance is reduced by dehydration of as little as 2% of body weight. Casa, D.J., Clarkson, P.M., Roberts, W.O. (2005) Proper hydration reduce core temperature. Lopez et al, 2011
Illness	Reduced thermoregulation due to fever, dehydration and medication. Burgeron et (2005)
Previous history of EHI	Possible widespread debilitation of thermoregulation, central nervous, cardiovascular, musculoskeletal, renal and hepatic systems. Adams, W.M., Hosokawa, Y., Casa, D.J. (2015)
Medication and drugs	Those medications or drugs that result in dehydration or increased metabolic rate or have an adverse effect on thermoregulation. Roelands et al (2008)

2.7 Outcomes associated with EHI

In a retrospective study, 28 patients (25 soldiers, 2 construction workers and 1 student) were diagnosed with exertional heat stroke at a military hospital in Thailand, from 1995-2007, demonstrating associated multi-organ failure. The authors noted that early diagnosis and proper treatment of EHI resulted in better outcomes (Sithinamsuwan, et al., 2009). Retrospective outcomes from 1996 – 2006, presented by Zeller, Novak, Barski, Jotkowitz and Almog (2011), of 32 patients (>18 years) diagnosed with exertional heat stroke in Israel, noted organ system dysfunction in terms of neurological, cardiovascular and renal function manifestations. Two patients required short term haemodialysis, which subsequently normalised and two patients died on arrival at hospital. The patients also presented with elevated liver enzymes and rhabdomyolysis.

Ghaznawi and Ibrahim (1987) noted a very high (20-50%) mortality rate for Haj (religious) pilgrims in the Middle Eastern country of Saudi Arabia. Shapiro and Seidman (1990), in the Middle Eastern country of Israel, noted complications for EHS to include dysfunction to central nervous, cardiovascular, pulmonary and gastrointestinal systems, often with renal and hematologic involvement.

There is a lack of collated information on outcomes for the other forms of EHI, with American College of Sport Medicine (2007) and National Athletic Trainers Association (2015) noting that athlete be removed from training or sport and reviewed by physician if diagnosed with exercise-related heat syncope, heat exhaustion, and a return to play during the same session for exercise-associated muscle cramps.

2.8 Prevention recommendations for EHI

Environmental heat stress, history of heat illness, poor physical fitness, obesity, illness resulting in dehydration and fever, predisposing medical conditions, certain medication and drug use pertaining to EHI, and dehydration are considered risk factors for developing EHI (American College of Sport Medicine, 2007; National Athletic Trainers Association, 2000, National Athletic Trainers Association, 2002). There are no known differences in risk factors between adolescent or adult athletes (Kerr, Casa, Marshall & Comstock 2013; Cleary 2007). These risk factors negatively

affect the thermoregulatory ability of the body, resulting in increased core body temperature and thus the possible development of EHI. Sithinamsuwan, et al., (2009), in a retrospective study, noted associated multi-organ failure in 28 patients diagnosed with EHI. The authors demonstrated that early diagnosis and proper treatment of EHI resulted in better outcomes.

The Inter-Association Task Force (Casa, et al., 2013) developed best practice recommendations for the reduction of sudden death, as result of variety of conditions, during collegiate and secondary schools (USA) sports conditioning sessions. The recommendations specifically referring to prevention of EHI include the following: gradual acclimatisation, slow introduction of new conditioning activities, avoidance of exercise as a form of punishment, proper education (about risk factors, focusing on hydration needs, acclimatisation, work/rest ratio, signs and symptoms of EHI, treatment, dietary supplements, nutritional issues and fitness status), accreditation of strength and conditioning staff, provision of sufficient and adequate medical coverage, development of emergency action plans, raising awareness of medical conditions which may predispose to EHI, activity modification dependent on wet bulb globe temperature (WBGT), avoidance of exercise if ill or recovering from febrile illness, and training of those involved to be able to monitor for signs and symptoms of EHI.

There appears to be consistency amongst the recommendations for the prevention of EHI. These recommendations include identification of risk factors (American College of Sport Medicine, 2007; American Academy of Paediatrics, 2011); education regarding risk factors (National Athletic Trainers Association, 2015; Howe & Bowden, 2007), and symptoms of EHI although there is still no clarity in how to identify the symptoms or what these include (National Athletic Trainers Association, 2015; Pryor, Casa, Holschen, O'Connor & Vandermark, 2013; Oded, et al, 2003). In recommendations regarding acclimatisation and hydration, there are full details in some literature (National Athletic Trainers Association, 2015; Lipman, et al., 2014; American College of Sport Medicine, 2007) literature but a complete lack in others (Olympia & Brady, 2013; Oded et al, 2003). National Athletic Trainers Association (2015) recommendations suggest that 7–14 days are required for heat acclimatisation and that the acclimatisation will be lost if is not maintained.

The following is a modification of National Athletic Trainers Association (2015) infogram on heat acclimatisation for American Football: During day 1-2 of training the athlete can take part in a single 3-hour session or 2-hour practice and 1—hour field session with the use of helmet in American football; days 3–4 is similar to day 1-2 but adding shoulder pads; day 5 is similar again but with full pads and from day 6 onwards 1 day break between days of multiple practices but total practice time not exceeding 5 hours, with walk-throughs no more than 2 hours.

Hydration recommendations in National Athletic Trainers Association (2015) refers to National Athletic Trainers Association position statement on fluid replacement in athletes (National Athletic Trainers Association, 2000). The recommendation in National Athletic Trainers Association (2000) included the following: Establishing a hydration protocol for athletes; easily accessible fluid-replacement beverages; starting exercises well hydrated that is facilitated by pre-exercise hydration, consuming approximately 500 to 600 mL (17 to 20 fl oz) of water or a sports drink about 2 to 3 hours prior to and 200 to 300 mL (7 to 10 fl oz) of water or a sports drink 10 to 20 minutes before exercise. Fluid replacement should maintain hydration at less than 2% body weight reduction and approximate sweat and urine losses, which is approximately 200 to 300 mL (7 to 10 fl oz) every 10 to 20 minutes. Post-exercise replacement must attempt to correct any fluid loss as result of the practice or event, preferably within two hours and rehydration should contain water, carbohydrates and electrolytes to speed up the hydration process. Athletes should consider the addition of sodium chloride in fluid-replacement beverages when there is inadequate access to meals or meals are not eaten. Post-exercise replacement should be considered when physical activity exceed 4 hours or during the initial days of hot weather for a total of 0.3 to 0.7 g/L.

A concern is the lack of higher level evidence supporting these recommendations, with most noted supporting evidence using category C (SORT, Table 2.1), indicating that there is insufficient research to determine if the intervention is effective in what it proposes to achieve. A lack of reference to proposed quality level of supporting evidence is found in the American College of Sport Medicine consensus statement of 2007, raising questions as to the validity of the recommendations. The highest level of supporting evidence is for measurement of rectal thermometry, an objectively measureable outcome. The recommendations following the outcome of the measurement (rectal thermometry) has demonstrated the guidance and effectiveness of the treatment for exertional heat stroke (National Athletic Trainers Association 2015; American

College of Sport Medicine 2007). If rectal thermometry confirms EHS, the recommendations are aimed at reducing core temperature as soon as possible with aim to 'cool before transport'. These recommendations include the quick immersion of the whole body in a pool or tub of cold water. Cold-water immersion up to the neck is most effective with water temperature about 1.78 ˚C (35.2 °F) to 1.58 °C (34.8 °F) stirring continuously and remove patient once their core body temperature has reached 38.98 °C. Partial-body immersion (i.e., torso) with a small pool or tub or wet ice towels rotated and placed over the entire body. Cold-water dousing is advised with or without fanning when cold-water immersion not possible and there are medical personnel on-site; aggressive cooling is advised when not on site and when an athlete should be transported to hospital immediately.

A lack of clear details regarding the recommendations within the articles (Appendix N), could be a barrier to recognition and assessment of EHI for the supporting staff that might be first-aid volunteers, coaches, teachers, and management who are not always medically trained. It is questionable whether supporting staff have the skill in appraising an article to evaluate if recommendations are applicable or whether there is sufficient evidence to support a recommendation.

At present, the author is not aware of any studies evaluating the effectiveness of the application of preventative recommendations on the outcome in either the incidence or prevalence rate or morbidity and mortality associated with a diagnosis of EHI. The lack of studies looking at effectiveness ads to the confusion regarding recommendations or that there is no evidence to suggest that we can use these recommendations with confidence.

2.8 Assessment recommendations for EHI

Exercise-associated muscle contractions (EAMC) are considered present when cramping is visible in part or all of a muscle or muscle groups, or when the athlete experience localised pain, dehydration, thirst, sweating or fatigue. Stone, et al., (2003) in their cross-sectional survey, noted that certified athletic trainers in the USA identified the perceived causes, treatment and prevention to be based on dehydration and electrolyte imbalance when dealing with EAMC, irrespective of new theories being available. Stone et al., (2003) therefore advised that newer theories regarding

EAMC be incorporated into athletic trainers' education. In the National Athletic Trainers Association (2015) position statement on EHI, there was no evidence that this advice was heeded as treatment focus was still on hydration and electrolyte restoration strategies.

Recommendations by National Athletic Trainers Association (2015) only referred to a brief episode of fainting with concomitant dizziness, tunnel vision and a low core temperature of below 39 °C at the end of training session or standing in the heat to be able to diagnose heat syncope. The authors of National Athletic Trainers Association (2015) assigned a SORT evidence category, B and C support (Table 2.1), for the assessment of exercise-associated heat syncope without them identifying any available research on how to identify tunnel vision, and pale or sweaty skin within these recommendations. Therefore, these recommendations are based on usual practice or opinion as no articles referring to either consensus statements, case series or disease-orientated evidence was presented.

According to Jardine (2007), the most common cause of syncope in young adults is neurogenic syncope which presents with similar symptoms as associated with heat syncope. O'Keefe and Sanson (n.d.) described various differential diagnoses of symptoms for blurred vision, hot flashes and feeling faint.

In exertional heat exhaustion, symptoms include excessive fatigue, fainting, collapse with minor cognitive changes (headache, dizziness, confusion) while performing physical activity. The addition of evaluation for bizarre behaviour, hallucinations, altered mental status, confusion, disorientation or coma will increase the suspicion for exertional heat exhaustion (American College of Sport Medicine, 2007; National Athletic Trainers Association, 2002; National Athletic Trainers Association, 2015). There are many reasons for fatigue (Noakes & Gibson, 2004), dehydration (NHS Choices, n.d.) and muscle cramping (Miller, Stone, Huxel, & Edwards, 2010). Symptoms and signs of exertional heat exhaustion (National Athletic Trainers Association, 2015; American College of Sport Medicine, 2007) are also associated with various other conditions like dehydration (NHS Choices, n.d.) and gastroenteritis (Elliott, 2007), which again reduces the ability to accurately diagnose exertional heat exhaustion during training or a game. The use of rectal thermometry is used to differentiate EHS, with a core temperature above 40.5 °C from exertional heat exhaustion with a core temperature below 40 °C, as both categories (EHS and exertional heat

exhaustion) share symptoms with CNS dysfunction. This rectal thermometry has a SORT (Table 2.1) evidence category A. However, this only confirms EHS but does not necessarily exclude or include a diagnosis of exertional heat exhaustion. The accompanied presentation of CNS dysfunction and a core temperature above 40.5 °C confirms EHS (American College of Sport Medicine, 2007), but due to the non-specific nature of CNS dysfunction, exertional heat exhaustion is neither confirmed nor denied with a temperature below 40 °C, (Noakes, 2008).

Recommendations from National Athletic Trainers Association (2002) and American College of Sport Medicine (2007) specifically aimed at providing assessment via rectal thermometry to determine core temperature and treatment inclusive of whole-body cold-water immersion, is noted above. Certified athletic trainers in the United States are not confident in using correct assessment instruments and are applying inferior treatment methods for only the EHS category of EHI (Mazerolle et al., 2010).

Athletic trainers are not using recommended assessment instruments and treatment methods and cite a lack of training, equipment and invasiveness of rectal thermometers as barriers to diagnosis of EHS (Mazerolle, et al., 2010). In their follow-up study, Mazerolle et al. (2011), identified five themes that act as barriers to the implementation of recommendations specifically referring to EHS, the more severe form of EHI. These included lack of knowledge, comfort level of both rectal thermometer administrator and athlete being assessed, lack of initiatives, liability concerns and lack of resources.

There is sufficient agreement (National Athletic Trainers Association, 2015; American College of Sport Medicine, 2007; Noakes, 2008) that EHS is the only form of EHI that can actually be assessed objectively and have distinctive features that make diagnosis easier. The definition of EHS is a core temperature above 40.5°C, collapse and CNS dysfunction (disorientation, confusion, dizziness, loss of balance, staggering, irritability, irrational or unusual behaviour, apathy, aggressiveness, hysteria, delirium, loss of consciousness and coma), with other signs and symptoms possibly including dehydration. How to measure dehydration is not actually referred to in most recommendations.

However, in National Athletic Trainers Association statement (2015), the authors suggested that the measurement of body-weight change before, during, and after a practice or an event and across

successive days is the preferred method for monitoring dehydration in the field. This suggestion does not have a reference and further refers to using clinical refractor or monitoring first-void in the morning to determine hydration status. Armstrong (2007), following his review of hydration measurement techniques, suggested that accuracy and measurement resolution are not supported by large, consistent research. He also argued that dynamic hydration is inadequately represented by (a) a single measurement in time and (b) questionable measurement techniques. Further symptoms that would indicate possible dehydration include hot and wet skin, hypotension and hyperventilation (National Athletic Trainers Association, 2015; American College of Sport Medicine, 2007).

Important to note is that none of the recommendations described the actual measures of how to determine CNS dysfunction, hot and wet skin, hypotension and hyperventilation (other associated symptoms of EHS). Therefore, being able to objectively measure core temperature with the use of a rectal thermometer (Casa et al., 2007) supports the ability to identify EHS, as well as recognition of CNS dysfunction. The only assessment recommendation without any controversy is that of rectal thermometry (Casa, et al., 2007(b); American College of Sport Medicine, 2007; National Athletic Trainers Association, 2015) to assess core temperature to facilitate the diagnosis and management of EHS. This is on the basis of measurable outcomes used and evidence indicating that the proposed treatment method results in improved outcomes (Sithinamsuwan et al., 2009). Noakes (2008) further argued for a change in the definition of EHI, suggesting that only EHS be considered as there is sufficient evidence for an elevation of the core body temperature to result from a pathological process.

Although some authors acknowledged that some of the signs and symptoms of EHI are not distinctive or cannot be differentiated significantly enough, they still continue to provide suggested signs and symptoms to help recognise or diagnose different forms of EHI, except for EHS. This begs the question as to why they would still recommend the ability to diagnose a specific form of EHI based on common practice, even though not enough evidence is available. This lack of sufficient supporting evidence in our assessment methods for the various forms of EHI, except for EHS, would provide further argument for only considering diagnosing EHS as the only form or category of EHI.

2.9 Treatment recommendations for EHI

It is recommended that exercise-associated muscle contractions are treated with rest and passive stretching, which is supported by theories, as proposed by Schwellnus (2009), suggesting that the cause is neuromuscular dysfunction in nature. However, there are still recommendations regarding sodium replacement and even intravenous fluid administration in cases of sodium deficit (National Athletic Trainers Association, 2015), which base the underlying cause on dehydration and electrolyte dysfunction (American College of Sport Medicine, 2007; National Athletic Trainers Association, 2015).

The scope of practice for very few, if any sports physiotherapist include the use of equipment for intravenous fluid administration, making this an irrelevant recommendation, especially in an amateur environment with a lack of medically trained personnel. There are currently various on-field tests (Godek, et al., 2010) available for determining sodium deficits; however, not all are very practical and the validity of commercially available equipment has not been described. Therefore, the administration of intravenous fluids is controversial and also impractical as this would require a medically trained professional who has the infrastructure to support this function to be at training or game grounds.

Exercise-associated heat syncope recommendations refer to the removal of an adolescent to a shaded area, elevation of legs above heart level and monitoring of vital signs (American College of Sport Medicine, 2007; National Athletic Trainers Association, 2002 & 2015; Lipman et al., 2014). Most recommendations agreed that heat syncope should be managed with elevation of the legs, removal of athlete to a shaded area and the provision of fluids. This treatment is only effective if the cause of the syncope has been identified as exercise-induced syncope, which, according to Kapoor, Karfp, Maher, Miller, and Levy (1982) is very rare. This is a concern as none of the recommendations demonstrate how to identify the underlying cause of heat syncope or when to refer a patient for further evaluation.

The treatment recommendation for EHS is whole-body cold water immersion and is considered the most effective strategy (Casa et al., 2007a). The cardiovascular collapse and shock associated with EHS can be reversed by cold water immersion, with associated reductions in morbidity and

mortality observed (Sithinamsuwan, et al., 2009). However, there is further agreement that if cold water immersion is not available, various forms of cooling, e.g. ice-water towels, ice pack (placed in groin, neck, axilla) are as effective in reducing core temperature (McDermott et al 2009b). The time frames for the various cooling methods are available in the article by McDermott, et al., (2009a)

There are similar recommendations for the management of EHS, but not complete agreement in the other forms of EHI; for example Lipman, et al. (2014) states that no sufficient evidence for lighter forms of EHI is available and American Academy of Sport Medicine (2007) did not have any support evidence for their recommendations.

2.10 The Middle Eastern Context

There is currently no literature available on EHI within the adolescent age group, in the Middle East. Most adolescent athletes leave Dubai at the end of school year (last week of June) to return to their country of origin e.g. USA, Canada, Australia, European countries, with little structured exercise during the northern hemisphere summer. Thus, they return during first week of September with reduced fitness levels in over-weight middle school children (Carrel, et al., 2007) and little if any heat-acclimatisation (Casa & Csillan, 2009). The new academic year starts at the beginning of September, a period when new expatriates and returning students will join schools and sports clubs. Thus, athletes will return to or start training at the height of northern hemisphere summer, with increased risk factors for the development of EHI and specifically EHS (American College of Sport Medicine 2007, National Athletic Trainers Association, 2002).

In the Israeli (Middle Eastern country) military environment, educational programmes regarding EHI are suggested to increase the awareness of medical staff and commanders (Rav-Acha et al., 2004). As EHI is considered a preventable condition (Epstein, Sohar, & Shapiro, 1995), taking morbidity and mortality into account, knowing whether EHI does occur will allow sports clubs to plan accordingly for EHI. Thus, raising awareness for this condition becomes very important.

Union rugby and football clubs in Dubai practice in an outdoor environment on either artificial or natural turf. The intensity of training is not specifically set but tend to be maintained at a level determined by the coach. Players are grouped according to age rather than ability. If placed in

similar ability groups, this would allow players of the same ability to work at a similar rate. Therefore reducing the chance of development of EHI in the player with reduced ability needing to work at a higher intensity rate. Union rugby utilises volunteers to assist with first-aid, especially in the adolescent age group. It can be deduced that these rugby volunteers do not have adequate knowledge and skills to recognise or treat EHI. The Dubai Annual Health Statistical Report (Dubai Health Authority, 2012) did not report on EHI or classical heat stroke as a cause of death within the emirate of Dubai, UAE.

A higher WBGT increases the risk to develop EHI, and data from September (1978-2012) in Dubai shows temperatures, ranging between a minimum of 26–30 °C to a maximum of 36–39 °C and a humidity of 31-91% (Weatherspark, 2012). Exercises in these environmental factors would increase the risk for development of EHI.

As there is no reporting of EHI in Dubai, the question arises whether this reflects a lack of knowledge in assessment or is this a lack of awareness about EHI? Considering the risk factors, as noted earlier, all of which are evident in Dubai, some EHI should present. Therefore, in order to raise awareness of this condition, determining the vulnerability of youth athletes concerning EHI is a start. This would hopefully raise awareness, not only among clubs (administrators, parents, coaches, and medical personnel) but also among medical researchers participating in further investigations regarding EHI within youth sport in the Middle East, to ensure the safety of all athletes.

2.11 Summary

Although there are recommendations available for the prevention aspect in the management of EHI, there is not enough evidence to facilitate their adoption. Even though some recommendations acknowledged that some of the signs and symptoms of EHI are not distinctive or does not assist in differential diagnosis, the authors still continue to provide suggested signs and symptoms to help recognise or diagnose different forms of EHI. There is agreement as to the ability to diagnose EHS, which is the most severe form of EHI. This then follows that the recommendations for the treatment of EHS is accepted but disagreement for the other categories of EHI are apparent.

Chapter 3: Methodology

3.1 Study setting

The study was conducted at various amateur clubs offering union rugby or football in the Middle Eastern city of Dubai, UAE. The UAE has a topographic nature of desert and a tropical dry climate, with high humidity and temperatures throughout the period of the research (State of the environment report UAE, 2015). The three clubs that participated, provide training sessions by qualified coaches, for ages starting from 5 – 19 year olds. There are no criteria for being part of the club. Thus irrespective of skill, or fitness level or experience playing the sport, any athlete is welcome to join their club of choice. Club training occurs on natural or artificial turf. During the week training occurs after school and at weekends in the morning. The humidity and temperature is lower during the week days as compared to weekend. The clubs make use of trained first-aid volunteers to help with either training or game day injury management. The study was conducted during a single training session at the start of the 2015/2016 season, during the month of October. This was later than anticipated as local Dubai ethical approval was only received at the end of September 2015.

3.2 Study design

A cross-sectional, descriptive design was used to address the research questions. The design allows for observation of a collection of information without changing any aspect of the training. This is reflective of both the environment and the physical aspects of the study setting and population. Therefore the design allow for collection of the selected risk factors as they occur, the self-reported EHI symptoms present and hydration practices as they occur on the day. Therefore a true reflection of what occurs during a normal training session at an amateur sports club.

3.3 Study population

Adolescents (male and female) aged between 10 and 19 years, who participated during the 2015/2016 season in the union rugby and or football sporting codes in Dubai, UAE, comprised the study population. There were three clubs that indicated that they were willing to participate, one from union rugby and two from football. A total number of 49 union rugby and 62 football participants was recruited.

3.4 Sampling and recruitment

Population sampling was applied. An email (Appendix A) was forwarded to all six union rugby clubs registered, in Dubai, with the United Arab Emirates Ruby Association (UAERA), and included the UAERA Development Programme for Dubai. The six United Arab Emirates Football Association (UAEFA) registered football clubs in Dubai were also contacted via email and phone. In addition, five soccer clubs registered as corporate entities were emailed and phoned. The recruitment occurred during September 2015, which was later than expected.

A positive response was received from three clubs, followed by a special meeting with players, parents and support staff at the clubs to present information (Appendix B and K) about this study. Therefore the information session was arranged at one club from rugby union and two clubs from football. The information session was held on 28 & 29 September 2016. Consent and assent forms (Appendix B & C) were distributed, by the principal investigator, via email to parents/guardians and participants to familiarize themselves with the content. Consent and assent forms were distributed and collected on the day of data collection by both principal investigator and assistants.

Data collection could only be arranged for October. This presented a problem as the study's aim was to establish self-reported symptoms of EHI during the first few weeks of the season before heat acclimatisation has occurred. The reason being that once acclimatisation has occurred, the risk for EHI is reduced.

3.5 Eligibility criteria

3.5.1 Inclusion criteria

Male and female adolescents aged 10-19 years of any nationality (the population of Dubai is multi-national) who participated in the union rugby and or football sporting codes, were included the study population. Players had to be registered at the above-mentioned clubs in Dubai, UAE.

3.5.2 Exclusion criteria

Adolescents with physical disabilities were excluded, as at present they did not participate in able-bodied union rugby or football. Players who sustained severe physical injuries resulting in immediate cessation of participation in training session were also excluded as this could possibly

affect the different symptoms. An inability to complete the training session could also be perceived as associated with exertional heat illness; however, clarity as to the reason for cessation of training needed to be gained. Therefore the need to identify acute injury during training session as reason for cessation. Acute injury could be muscle strains or tears, joint sprain, ligament, "grass burns" and serious injury for example fractures or dislocations or concussions as diagnosed by first-aiders.

3.6 Sample size

Since this was a descriptive study and a specific hypothesis was not to be tested, the sample was representative of all participants who agreed to participate in the study. All potential participants in Dubai were contacted and a response rate was determined. The population comprised of 2500 registered athletes (10-19 years old) at official sports clubs for the 2014/2015 season. Considering that there are no literature in the Middle East within the adolescent sports players and arguments that a true incidence rate cannot be calculated. Therefore, calculating a sample size would not be true reflection. A total of 111 participants compromised the study sample size.

3.7 Measurement tools and procedures

3.7.1 Self-reported EHI symptoms

To measure self-reported symptoms of EHI, a questionnaire (Appendix E) based on symptoms as indicated in the American College of Sport Medicine (2007) and National Athletic Trainers Associations (2002) position statements, were used. Refer to Table 3.1 below for symptoms.

Table 3.1: EHI symptom category and presentation

SYMPTOM	PRESENTATION
Exercise-associated muscle cramps	Acute, painful & involuntary muscle contraction
Heat syncope & exercise-related collapse	Inability to stand upright or walk independently as a result of light-headedness, more often at completion of training/game
Heat exhaustion	Inability to continue exercise associated with, normal CNS function, heavy sweating, pallor, "prickly heat" sensations, headaches, abdominal cramps, nausea, vomiting, diarrhoea, persistent muscle cramps
Exertional heat stroke	Collapse, presence of CNS dysfunction,

In addition to the symptoms indicated above, a questionnaire (Appendix D) also included demographics, duration of training session during the study, risks (medical conditions and

medication usage) and acute sports or other traumatic injuries since the season started and the management thereof. The questionnaire was administered after the training session by principal investigator and assistants to capture the presentation of any of these symptoms during the training session.

3.7.1.2 Questionnaire validation

A validation process (Appendix F) had to be implemented in as the questionnaire was newly developed and the researcher had to ensure that table of symptoms corresponded to symptoms in literature. The following panel members were invited to participate in the validation process of the questionnaire and symptom presentation table:

- Prof. R. J. Maughan

Professor Maughan is a Fellow of the American College of Sports Medicine and received that organisation's Citation Award in 2007. He is also a member of the Physiological Society, the Nutrition Society, the Biochemical Society, and the Medical Research Society. He chaired the Human and Exercise Physiology group of the Physiological Society for 10 years and was a member of the Council of that organisation. He is Chair of the Sports Nutrition group established by the IOC Medical Commission in 2002 (http://www.lboro.ac.uk/departments/ssehs/staff/ron-maughan/).

- Prof D.J. Casa

For the past 17 years, Dr. Casa has worked toward his goals at the Department of Kinesiology, College of Agriculture, Health, and Natural Resources, University of Connecticut. During this time he has published more than 200 peer-reviewed publications/book chapters and presented more than 400 times on subjects related to exertional heat stroke, heat-related illnesses, preventing sudden death in sport, and hydration. Dr. Casa has successfully treated 225 cases of exertional heat stroke (with 0 fatalities). In October 2005 and 2010 the Department of Kinesiology doctoral program at the University of Connecticut was ranked number 1 in the country by the National Academy of Kinesiology (for 20005-2105). Additionally, in September 2010 the National Research Council ranked the faculty in the Department of Kinesiology number one for research productivity, (https://kins.uconn.edu/douglas-j-casa/).

- Dr. S. Racinais

Since joining Aspetar in 2007, Sébastien has developed a research program on the adaptations of the human body to hot ambient conditions and their repercussions on sport performance. He created and runs a Special Interest Group (SIG) of physiologists with a strong interest in environmental physiology. SIG aims to provide scientific support, educational resources and occupational health and safety guidelines on exercising in hot environments. Sébastien has also been collaborating with various international sports federations on consensuses on exercising in hot ambient conditions, (http://www.aspetar.com/person-profile.aspx?id=63&lang=en).

- Dr. J. Periard

Dr. Périard is an Associate Professor at the University of Canberra Research Institute for Sport and Exercise. He is also an Adjunct Senior Lecturer at University of Sydney and former Research Scientist and Head of Research Operations for the Athlete Health and Performance Research Centre at Aspetar. His scientific expertise lies in the area of environmental physiology. His integrative approach to research examines the physiological mechanisms that mediate health and performance in adverse environments (heat and altitude). He has worked with both amateur and professional athletes from various disciplines, along with National and International Federations and occupational work groups. He has published several book chapters, over 45 manuscripts, and has presented at international conferences, including the IOC World Conference on the Prevention of Injury and Illness in Sport, and the IOC Advanced Team Physician Course. Dr. Périard is an Associate Editor for *Front Physiol* and has served as Guest Editor for supplements issues in the *Br J Sports Med* and the *Scan J Sci Med Sport*. His research has been recognised by the Canadian Society for Exercise Physiology, Exercise and Sports Science Australia, the Physiological Society, and the Society for Tennis Medicine and Science, (https://researchprofiles.canberra.edu.au/en/persons/julien-periard).

Responses with comments were received from Prof. Casa and Dr. Racinais. (Appendix G)

Dr. Racinais commented “Get somebody (e.g. parent) with the adolescent to help them filling out the vulnerability and hydration practices questionnaire.” Prof. Casa suggested that terms be changed and added sentence revisions by changing words, like “gender to sex”; “training start time and duration” to “typical training duration”, and “Any previous episodes of exertional heat illness, please select” to “Have you experienced any previous episodes of exertional heat illness?”

Further communication with Prof. Casa was the justification of the use of terms which are more familiar in the region and more often used, e.g. “gender” rather than “sex” The continued use of “start time” which could facilitate possible comparisons between different starting times, and durations to EHI. The justification to use shorter sentences were based on the relative short attention span of children and minimising agitation as other data still needed to be collected and through this, the possibility that the data collection could interfere with actual training session, was minimised. Prof. Casa acknowledged the differences in local culture (word usage) and reducing the time spent reading during data collection, to allow participants to complete the questionnaire in as short a period of time. Therefore no changes were made to the original vulnerability and hydration practices questionnaire.

The questionnaire and table of symptoms was accepted by both respondents.

3.8 Measurement of selected risk factors of EHI

The questionnaire (Appendix D) mentioned above included questions about medical conditions, medication and hydration practice.

3.8.1 Medications and medical conditions

Medication use and medical conditions associated with EHI risk were obtained via the questionnaires (Appendix D), which were developed by the principal investigator. The participants were able to select the conditions and name medication applicable to them. Certain medications and medical conditions are considered risk factors (American College of Sport Medicine, 2007; National Athletic Trainer Association, 2002) and therefore this section would elicit an appropriate response to help identify if this risk is present. The information session (Appendix K) allowed for explanation of medical conditions and medications.

3.8.2 Hydration practices

Information about the type of fluid intake, when they drink fluids and why they drink fluids was also obtained via the questionnaire (Appendix D), for the period prior to, during and after the training session. There are hydration recommendations which would facilitate euhydration or minimise dehydration,

(National Athletic Trainer Association, 2000). This will allow for possible comparison with recommendations and to determine volume consumption association with self-reported EHI symptoms or not.

3.8.3 Obesity

Obesity refers to a measure of excess body fat, with the instrument most frequently used due to cost effectiveness and practicality being the BMI-for-age (Appendix H) index. Thus weight and height measurements (anthropometrical) were used to determine BMI-for-age through use of the standardised mathematical equation of weight/height^2. As noted in American College of Sport Medicine, (2007) and National Athletic Trainer Association, (2002), obesity is a risk factor for the development of EHI.

However, interpretation is dependent on which specific indices are used. The specific index used for this study was the World Health Organization's (WHO) BMI-for-age index, as the sample in the study consisted of various international expatriates. This index use international reference standards to interpret the outcomes. The WHO BMI-for-age index was developed from anthropometric information from 846 surveys from both developed and developing countries. The authors concluded that this provided international comparative data, identify populations in need, assessment of public & nutritional interventions, monitoring trends and raising awareness of nutritional concerns (de Onis & Blossner, 2003). Comparison between different indices is difficult as each index uses its own reference ranges, thus providing different obesity rates when evaluating same sample.

3.8.4 Procedures for weight and height measurement.

3.8.4.1 Weight measurement

Participants were measured without their boots and heavy outer clothing such as their training kit, except shorts and t-shirt or vest. Detecto apex® Digital Physician Scale with Medical Height Rod was used as a measurement instrument. This instrument provide measurements in both metric and imperial units, with capacity up to 300kg and 218cm. The equipment was placed on a level floor next to the club house used by the different clubs. Measurement was taken by either principal investigator or assistant. Each measurement was taken only once.

1. The scale was activated by turning it on and making sure the scale is set on "kg" (measurement unit) to indicate the weight of the participant.
2. The participant was asked to remove shoes and any heavy clothing such as jackets, sweatshirts, sweaters, etc.

3. The participant was asked to step onto the scale. The principal investigator or assistant ensured that the subject was centred on the platform and arms are at his/her side.
4. The weight appeared on the display panel. If the weight changed (e.g. from 45.1 kg to 45.2 kg), either number was recorded. Out of respect for participant's privacy, weight was recorded so other subjects could not see
5. The weight was recorded on the data collection sheet, ensuring it was accurate and legible.

The weight measurement session occurred immediately before the training session. The same protocol was followed immediately after training.

3.8.4.2 Height measurement:

Participants were measured without their boots and heavy outer clothing such as their training kit, except shorts and t-shirt or vest. Detecto apex® Digital Physician Scale with Medical Height Rod was used as a measurement instrument. This instrument provide measurements in both metric and imperial units, with capacity up to 300kg and 218cm. The equipment was placed on a level floor next to the club house used by the different clubs. Measurement was taken by either principal investigator or assistant. Each measurement was taken only once. The measurement unit was centimetre.

Participants were measured in their socks,

1. The participants was asked to remove or push aside any barrettes, braids, or hairstyles that may interfere with the measurement. Big hairstyles were flattened as much as possible.
2. The participant was asked to step onto the base.
3. The participant was told to look straight ahead, ensuring that their line of sight is level with the floor. The line from the hole in the ear to the bottom of the eye socket had to be parallel to the base. When the head was placed in the proper position in overweight, obese and older children, there was a space between the back of the participant's head and the back of the measuring board. The researcher ensured that the shoulders were level, the hands were at the participant's sides, and the head, shoulder blades and buttocks were against the board, if appropriate. The headpiece was then lowered on top of the participant's head, ensuring that it was pushed through the participant's hair.
4. As soon as the participant's position was correct, measurement was recorded.
5. Where any unusual problems were present, such as braids in the way or difficulty measuring the child, this was recorded next to the measurement on the sheet.

3.8.5 Physical fitness

Poor physical fitness was` measured using the international fitness scale (Appendix J).

3.8.5.1 Development and psychometric properties of the fitness scale:

This scale was developed, as an economically viable measure when compared to laboratory studies, to test physical fitness in larger population sizes. This scale is in the form of a 5-item questionnaire. A study by Ortega, et al. (2011) was undertaken among 3 059, 12-17 year old children by testing whether the questionnaire provide accurate categories of fitness. The categories included cardio-respiratory fitness (CRF), muscular fitness (MF), speed-agility (SP-AG), flexibility and overall fitness as compared to physical test outcomes of VO2 max (CRF), handgrip strength and standing long jump (MF), 4 x 10m shuttle run test (SP-AG) and back saver sit-and-reach test (flexibility). Re-test reliability was assessed among 277 adolescents (12 – 17 years old) by means of percent agreement and weighted Kappa coefficients (Ortega et al., 2011). This is a cost effective manner to identify if the risk of poor physical fitness would be present. The principle investigator is not aware of studies involving 10, 11 or 18, 19 year olds that assessed physical fitness and that has developed a recognisable outcome measure to cost effectively obtain physical fitness levels in large scale studies or environments.

3.8.5.2 Procedure

Each participant received The International Fitness Scale (Appendix J) questionnaire and was asked to personally complete this. This questionnaire was provided by principal investigator or assistants to each participant prior to training, and was asked to complete this before training started on the day of study. An explanatory introduction on completing the form was provided on the questionnaire. Further explanation regarding flexibility was given following a question during the information session (Appendix K). The questionnaire was collected after completion and prior to the start of training on the study day, by principal investigator or assistants.

3.8.6 Side-line support available, a check-list

The principal investigator used a check-list (Appendix I) to determine what form of support was available at training, specifically pertaining to EHI. This check-list included the following: Rapid body cooling (tubs with ice water) equipment, shade, hydration fluids, ice, monitoring/measuring wet bulb globe temperature

(WBGT) instrument, the availability of a rectal temperature measurement instrument, whether medically trained personnel and emergency action plans were available at the training site.

3.9 Enrolment and study procedures

3.9.1 Recruiting participants via registered clubs.

Recruitment happened during September 2015, four weeks before the start of first day of data collection. Local union rugby or football clubs were contacted (telephonic, then email & again telephonic follow-up) to inform them of the research and which population to be included. A description of research was provided by principal investigator and clubs were asked to contact parents informing them of the study, and to ask if they (parents) will consent to children participating in the research. In support of this, information on the study was emailed by the clubs and, a meeting on 28, 29 and 30 September 2015 (after approval of Dubai ethical approval was received) with parents, players, and all ancillary staff of clubs were arranged in order to provide clarity on the study and its importance. Consent and assent forms, highlighting the right to withdraw at any point, was provided and explained during the information session (Appendix L). No personal information (name and surname) was requested at any time, on the data collection forms, during the study. However, the following were required: completion of two questionnaires, and the collection of weight and height measurements. These procedures was concluded as described in paragraph 4.1 through to 4.5 under the “Measurement tools and procedures” section. The questionnaires (Appendix D & E) were not translated into Arabic languages as none of the respondents identified Arabic as their primary language

3.9.1.2 Response rate

Following a process of invitation to sports clubs in Dubai that offer union rugby and football, a response rate of 22.4% (n= 112) from a possible 500 participants which responded to the invitation to attend an information session on the research study. This has resulted in significantly lower number of participants than what was expected. This had a possible effect on the significance of the results as described by Button et al., (2013) whereby they argued that detecting a true effect and statistically significant result, are reduced in low-powered studies.

Figure 1: Flow chart of response to invitation

3.10 Pilot study

The pilot study was conducted to determine the face validity/clarity, estimated time to capture data and ability to analyse the data obtained. The pilot study was conducted approximately one day prior to start of actual study days. The pilot study was conducted among, ten, 12 year old football players. The principal investigator was present with the participants when they completed the questionnaires. Theses participants' information were not included in the final data analysed.

There were no comments, from the ten participants (five English and five Arabic speakers), forthcoming during the completion of the questionnaires. The time it took to complete the questionnaires varied from 10–15 minutes and other objective data collection took about eight minutes in total (referring to getting ready, recalibration and actual collection of data). This suggested that a minimum of 4 assistants would be required per study day.

3.11 Reliability

The reliability of the questionnaires (Appendix D & E) is questionable as no studies determined the reliability of the answers provided by the participants. This is understandable as this was a newly developed questionnaire.

3.12 Data storage

All data obtained during the primary study was entered into a Microsoft Excel Spreadsheet (Appendix J). All serial numbers were arranged so that all data collection forms could be piled according to serial number. This not only ensured that appropriate data, per participant, was transcribed on to excel data sheet, but that all consent and assent forms were accounted for. Physical data (questionnaire, fitness scale, and check-list) is stored in a dry, fireproof safe.

3.13 Data analysis

IBM SPSS was used to analyse the data. Both descriptive and inferential statistics were used to summarise the exposures listed in terms of means, proportions standard deviations and ranges for

continuous variables, and counts and proportions for categorical variables. The variables of gender, age, sport, time, various risk factors, hydration practices and outcome measure of EHI was summarised using descriptive statistics. Inference statistical analysis through Spearman correlations, t-test, Pearson chi-square, chi-square and one-sided Fischer exact tests was used to identify relationships between EHI risk factors, symptoms.

3.14 Recruitment of assistant(s)

Volunteer assistants were recruited, eight physiotherapists, to assist in obtaining the anthropometric details required for determining the BMI-for-age.

3.15 Assistant Educational Session

A session was held at the private clinical practice where the weight and height measurement equipment were stored. The principal investigator demonstrated to the assistants how the weight and height measurements were to be measured and collected. The principal investigator discussed and demonstrated measurements according to the details in the instruction guidelines, as outlined in 3.7.2.4 for weight and height measurements. Emphasis was placed on maintaining legibility and privacy of measurement recorded. It was explained that only one measurement will be taken to ensure faster completion and no resultant delay in starting training.

3.15 Information Session

Clubs were informed that if any Arabic native speakers were to be present at the meeting, a special meeting with an Arabic speaker (one of the assistants) would be arranged as simultaneous discussion would be too time consuming. The information session was held on 30 September and 1, 5, 6 and 7 October 2015.None of the clubs indicated that the any of the parents or players requested an Arabic language only session. All the attendees were greeted and welcomed by the principal investigator and assistants.

The principal investigator provided information on why the study was needed. The information highlighted was that in the USA, this condition (EHI) is a leading cause of death for young athletes and that the number of adolescents diagnosed each year has been increasing, again in the USA. The risk factors were shared, especially the importance of the environment and acclimatisation or the lack of acclimatisation. There were questions regarding the different medication and medical conditions. Full explanation of the conditions and medications considered risks were provided. It was also shared that if EHI is not treated appropriately, serious consequences could result. The fact that no information, regarding if adolescents in the Middle East has experienced this condition, highlighting the need to help identify or not if EHI does occur.

The concept of consent (parent indicating a positive response to allow the child to participate) and assent (the child or player in this instance providing a positive response in wanting to participate) was explained. It was highlighted that even if the parent provided consent, the player was still allowed to deny assent in participating. Another aspect was that even if the player provided assent at the start of the research, they could refuse to participate further at any time during the research. Emphasis on making an independent decision on participation, thus either parent or player should not feel or be pressed by others to participate. Copies of consent and assent forms were provided to parents and players, for the purpose of familiarisation and not for completion. The principal investigator systematically discussed the content of the consent and assent forms. The consent and assent forms were to be provided on the days of data collection by principal investigator or assistants. The parents wanted to know how weight after completion of training will be recorded onto the correct questionnaire if no name and surname was to be added on the forms and only a serial number were to be used. It was decided that the participants' name and surname will be written on an envelope, in which the questionnaires will be kept. This will ensure continuity of data collected. Some participants wanted to know why their names could not be on the questionnaires. The principal investigator explained that as little as possible information regarding participants should be available for others to use or to contact participants as anonymity of information is very important. It was further explained that only personal information and the data collected will be anonymous because the actual data collection will not be in private, rather at the training grounds. On the days of training other players will see when data collection occur.

The information that were needed and how it were to be collected was discussed. A date was agreed upon for the data collection. The parents and players were reminded about the need to attend training earlier than normal and that consent and assent forms will be distributed before the start of training sessions. The questionnaires will also be provided before training on the day and collected after training session has been completed.

The principal investigator thanked all for attending. Emphasis on importance for the need for the research but no person should feel obliged to participate.

3.17 Ethical and legal considerations

3.17.1 Approval

The approval of the Dubai Health Authority Research Committee (Appendix O) was received on 28 September 2015, while the approval from Stellenbosch University HREC (Appendix P), received on 22 June 2015, for study to be conducted in Dubai, UAE. The research conformed to Helsinki Declaration.

3.17.2 Informed written consent and assent

Signed consent by parents and assent by participants were gained prior to taking part in this study. Before distributing consent and assent forms, an information session was arranged regarding the study, as noted in section 3.15. During this session (Appendix L) the parents/guardians and adolescents had questions answered. The participants were informed that the consent and assent forms will be available on the day of data collection and provided by principal investigator or assistants.

3.17.3 Confidentiality and anonymity

Confidentiality during the actual study process was not guaranteed as the information sessions were held in groups and data collection occurred during training at the training grounds. However, the results of the data collected were confidential and no further reference to persons were to be

made in either the analysis of the results, or during the writing of the dissertation. Data was anonymised by assigning a serial number to each participant.

3.17.4 Translation

Translation of all data collection questionnaires into Arabic was only needed for the pilot study. None of the Arabic speakers requested an Arabic translation questionnaire during study.

3.17.5 Risk/benefit ratio

There was no actual risk during participation in the study. There were no invasive testing or administration of any treatment to the participants. There were to be a rather significant benefit as the outcome might highlight what is required to ensure that the sports practiced in Dubai are safe.

3.17.6 Vulnerable study participants

All participants were considered vulnerable as all were adolescents. However, none of the participants were isolated at any time during the study, with the coaching, first-aid staff of the clubs or parents and other participants always present.

3.17.7 Incentives / compensation for participation?

There were no incentives for taking part in the study.

3.18 Dissemination of information

Recommendations made from the study, if agreed by supervisor could be disseminated in the following manner:
To clubs: After completion of dissertation and on approval of supervisor to highlighting the need to develop knowledge in assessment and management of exertional heat illness

Development of emergency action plans for exertional heat illness to enhancing the safety of participants in local amateur environment

To local conferences: sharing information gained and conclusions made

To Publication: sharing information gained and conclusions made

Chapter 4: Results

4.1 Introduction

This chapter presents the results under the following headings: General overview of the results, including response rate to invitation from different clubs; characteristics of the study sample; selected self-reported risk factors, self-reported EHI symptoms, hydration practices, side-line support available and knowledge of over-hydration.

4.2 General overview of results

The conclusion of the validation process was that no changes had to be made to either the questionnaire or table of symptoms but a suggestion was made that a parent be present when the participant completed the questionnaire. The outcome of the pilot study was that there were no confusion or misunderstanding in the wording used in the questionnaire. The pilot study further confirmed the time-frames for data gathering as was suggested in the methodology chapter. A response rate of 22.4% (n= 111) was obtained from a possible sample of 500 participants.

The characteristics of the study sample are presented in table format. Presence and/or absence of selected self-reported risk factors, self-reported EHI symptoms, hydration practices, what side-line support was available and the knowledge participants had of over-hydration are presented. Through the use of IBM SPSS Statistics program various correlations were tested between the selected risk factors, hydration practices and self-reported EHI symptoms.

4.3 Characteristics of the sample

The characteristics of the study sample, inclusive of demographics (Table 4.1) demonstrated that most participants considered themselves to have average to good physical fitness and the majority (96%) maintained a normal BMI (18.5 - 24.9 kg/cm^2), with a mean age of 14 years (SD= 2.1). The gender is reflective of the majority of males (98.2%) dominating the sport of union rugby and football.

Table 4.1: Demographic characteristics of sample

Characteristic	n (%)
Age, mean (SD)	14 (2.1)
9	1 (0.9)
10	5 (4.5)
11	11 (9.9)
12	11 (9.9)
13	10 (9.0)
14	24 (21.6)
15	21 (18.9)
16	12 (10.8)
17	14 (12.6)
18	2 (1.8)
Gender:	
Male	109 (98.2)
Female	2 (1.8)
General physical fitness	
Poor	4 (3.6)
Average	47 (42.3)
Good	47 (42.3)
Very good	13 (11.7)
BMI:	
Underweight (<18 kg/cm^2)	11 (9.8)
Normal (18.5--24.9 kg/cm^2)	95 (85.5)
Overweight (25.0–29.9kg/cm^2)	4 (35.7)
Obese (30 – 34.9 kg/cm^2)	1 (0.9)

Table 4.2 presents the training characteristics of the sample with relative equal numbers of football (55.8%) and union rugby (44.1%) participants. The participants trained for an average of 82 minutes, though football duration was 75 minutes and union rugby duration was 90 minutes.

Table 4.2: Training Characteristics

Characteristic	n (%)
Sport:	
Football	62 (55.8)
Rugby	49 (44.1)
Training duration:	
75 minutes	52 (46.8)
90 minutes	59 (52.6)
Training dates:	
02-10-2015	25 (22.5)
23-10-2015	11 (9.9)
24-10-2015	19 (17.1)
30-10-2015	56 (50.4)

4.4 Selected Self-reported risk factors

Only 8.1% of participants reported to have a history of EHI diagnosis, with dates varying from three years to three months prior to data collection. A further 7.2% of participants reported to be ill on the day of data collection and 8.1% during the two weeks prior to data collection. A total of 87.4% of participants noted that they sustained injuries over the last two weeks before data collection, for which some were receiving treatment. These results were obtained from the full study sample of 111 participants.

Table 4.3: Illnesses and Injuries

	n	%
Previous EHI		
No	102	91.9
Yes	9	8.1
Date of previous EHI		
13/01	1	
13/09	1	
14/06	2	
15/07	1	
16/07	1	
Not specified	3	
Illness today		
No	103	92.8
Yes	8	7.2
Illness today specified		
Cold	4	
Concussion	1	
Cough	1	
Runny tummy	1	
Not specified	1	
Illness in past 2 weeks		
No	102	91.9
Yes	9	8.1
Illness in past 2 weeks specified		
Cold	4	
Cough	2	
Flu	1	
Minor cold	1	
Runny tummy	1	
Injuries in past 2 weeks		
No	97	87.4
Yes	14	12.6
Injuries in past 2 weeks specified, and treatment		
Growth spurt	1	
Achilles, physio	1	
Ankle	1	
Ankle sprain, taping	1	
Bruised foot	1	
Grass burn, topical cream	1	
Groin, stretches	1	
Hyper-extended thumb joint, rest	1	
Knee	1	
Neck spasm, physio	1	
Hip, physio	1	
Pulled hami, stretches	1	
Pulled muscle, rest/ibuprofen	1	
Shoulder and elbow injury, strapping & gel	1	

Table 4.4 refers to the frequency of selected self-reported EHI risk factors, as well as how many participants identified one or more risk factors. None of the participants identified the medication or medical conditions considered risks for development of EHI.

A total of 19% of participants identified self-reported EHI risk factors. This implies that about one in every five participants reported a risk factor. Table 4.4 demonstrate the number of selected risk factors and injuries noted by participants. The identification of injuries were noted to ensure that reason for stopping the training session was clarified as result EHI or injury. The total of the selected self-reported risk factor was 31, of the 21 participants who had at least one risk factor.

Table 4.4: EHI risk factors

Risk Factor	n	%
Previous EHI	9	8.1
Illness on day of data collection	8	7.2
Illness in the past 2 weeks	9	8.1
Obese	1	0.9
Poor general physical fitness	4	3.6
Number of risk factors		
0	90	81.1
1	13	11.7
2	6	5.4
3	2	1.8

4.5 Self-reported EHI symptoms

EHI is an umbrella term (American College of Sport Medicine, 2007) that include the following symptoms (please refer to Table 2.4 and Table 3.1): Exercise-associated muscle cramps (EAMC), heat syncope and exercise related-collapse, heat exhaustion and exertional heat stroke with their accompanying presentations. The only self-reported presentation in the data was that of acutely painful and involuntary muscle contractions. This presentation represented the symptom category of EAMC within this umbrella term of EHI. Thus, from the study sample of 111 participants, a total of 14.4% (n= 16) participants self-identified EHI symptoms. The total number of self-reported presentations were 89.1% (n= 99), of these 16.1% (16 out of 99) can be classified as EHI,

83.8% (83 out of 99) did not qualify as EHI and 10.8% (12 out of sample of 111 participants) did not report any EHI symptoms. The self-reported EHI presentation can be viewed in Table 4.5. However, numerous participants reported presentations associated with the symptom category of heat exhaustion that can be viewed in Table 4.6. To qualify participants as displaying symptoms in the heat exhaustion symptom category, they should have collapsed during or after training and demonstrated associated presentations.

Self-reported EHI presentations that did not meet the full criteria, as well as total number of self-reported EHI presentations can also be viewed in Table 4.6. The rate at which self-reported EHI symptoms developed per participant (n=111) was 14.4%.

Table 4.5: Self-reported EHI presentation

Presentation	n	%
Exercise-associated heat cramps	16	14.4

Table 4.6: Self-reported EHI presentation that does not qualify for EHI

Symptom	n	%
Unable to continue	0	0.0
Very pale skin	1	0.9
Headaches	19	17.1
Nausea	1	0.9
Diarrhoea	1	0.9
Collapse	0	0.0
Drowsy	16	14.4
Inappropriate comments	0	0.0
Light headedness	0	0.0
Heavy sweating	93	83.8
Prickly heat sensation	11	9.9
Abdominal cramps	3	2.7
Persistent muscle cramps	1	0.9
Irrational behaviour	0	0.0
Number of presentations		
0	12	10.8
1	59	53.2
2	33	29.7
3	7	6.3

4.6 Hydration practices

The self-identified hydration practices can be viewed in Table 4.7. These self-reported practices were classified into whether or not participants used hydration fluids, inclusive of type, and when (in terms of how long before training), and volumes of fluids were consumed. From the total of 111 participants, 94.5% (n= 105) noted that they drank before training, with water the most abundant fluid at 86.7% (n=91); 70.5% (n= 74) drank between 5-30 minutes before training started. The volume consumed varied between 200-500ml to more than 1400ml, with the majority 80% (n= 84) drinking 200-500ml. All participants reported drinking fluids during training, with water (94.6%, n=105) again the dominant source and 33% (n=37) between 801-1100ml. The percentage of participants reporting to drink fluids after training was 100%. Water (55%, n= 61) was again the most prevalent fluid, consumed in 200-500ml quantities by 77.4% (n=82) participants.

Table 4.7: Hydration practices

	n	%
Fluid intake before practice		
No	6	5.4
Yes	105	94.5
Why no fluid intake before practice		
Not sufficient time	4	
Don't want to be slow or tired	2	
Type of fluid intake before practice		
Water	91	86.7
Juice	6	5.7
Sports drink	8	7.6
Volume of fluid intake before practice		
200 - 500ml	84	80.0
501 – 800ml	2	1.9
801 – 1100ml	1	1.0
1101 – 1400ml	13	12.4
Over 1401ml	4	3.8
Unknown	1	1.0
How long before practice was fluid taken		
5 – 30 minutes	74	70.5
31 – 55 minutes	10	9.5
56 – 90 minutes	15	14.3
Over 90 minutes	3	2.9

24 hours/day before	3	2.9
Fluid intake during practice		
Yes	111	100
Type of fluid intake during practice		
Water	105	94.6
Juice	6	5.4
Volume of fluid intake during practice		
200 - 500ml	23	20.7
501 – 800ml	9	8.1
801 – 1100ml	37	33.3
1101 – 1400ml	17	15.3
Over 1401ml	25	22.5
Fluid intake after practice		
Yes	111	100
Type of fluid intake after practice		
Water	61	55.0
Juice	10	9.0
Sports drink	40	36.0
Volume of fluid intake after practice		
200 - 500ml	82	77.4
501 – 800ml	4	3.8
801 – 1100ml	9	8.5
1101 – 1400ml	1	0.9
Over 1401ml	10	9.4

4.7 Knowledge of over-hydration and recognition

There were 9 (8.1%) participants who did not answer the question on whether or not they can drink too much. Seventy-seven percent of participants (n= 85) reported knowing that you can drink too much. The following reasons were given to support identifying whether they have drunk too much: A heavy feeling, a stitch or feeling bloated, a full tummy, frequent urination, feeling of water sloshing or moving in tummy, light coloured/clear urine, needing a toilet and inability to drink anymore. There were 3.6% (n= 4) of participants who were not sure and 10.8% (n= 12) of participants indicated that a person cannot drink too much fluid. The knowledge whether one can drink too much or how to identify when one has had too much fluid, are seen in Table 4.8.

Table 4.8: Knowledge of over-hydration

Can you drink too much?		
Not answered	9	8.1
No	12	10.8
Yes	86	77.5
Not sure	4	3.6
How to identify if drinking too much		
Not answered	25	22.5
Feels bloated/full/heavy	25	22.5
More frequent urination	7	6.3
Feels sick	6	5.4
Gets a stich	4	3.6
Light coloured/clear urine	24	21.6
Stomach hurts	13	11.7
No explanation	7	6.3

4.8 Side-line support

Only the two football clubs provided extra hydration fluids in the form of water, irrespective of the participants also providing their own fluid sources. The participants at the only union rugby club provided their own fluids. Both the union rugby and football clubs had small amounts of ice present, for minor/acute injury management but not sufficient for rapid cooling. None of the clubs had any of the following support available: Shading, rapid cooling equipment, equipment to measure WBGT or rectal temperature, medically trained personnel and emergency action plans available on the side-line.

4.9 Associations between risk factors and diagnosis of EHI

A comparison of the number of EHI risk factors and the number of EHI symptoms with age, BMI, level of general physical fitness, how long before practice fluids were consumed, and the volume of fluid intake before, during and after practice, was done through the calculation of Spearman

correlations, Table 4.9.The abbreviation rho, in Table 4.9 and in the paragraph below refers to Spearmen's rank correlation coefficient

Table 4.9: Spearman correlations with the number of risk factors and the number of EHI symptoms

	EHI risk factors			**EHI symptoms**		
	rho	***p-value***	***n***	***rho***	***p-value***	***n***
Age	0.023	0.811	111	0.117	0.222	111
BMI	0.074	0.440	111	0.080	0.404	111
General physical fitness	**-0.211**	0.026	111	**-0.206**	0.030	111
Fluid intake						
Length of time before practice	0.014	0.887	105	**0.253**	0.009	105
Volume before practice	0.079	0.423	105	**0.313**	0.001	105
Volume during practice	-0.011	0.905	111	0.109	0.254	111
Volume after practice	**0.197**	0.043	106	0.147	0.132	106

Note. Significant correlations are highlighted in bold

Several significant correlations were found, as shown in Table 4.9. Poorer general physical fitness was associated with more EHI symptoms (*rho* = -0.211, *p* = 0.026), which is to be expected, since one of the EHI risk factors was poor physical fitness. An additional significant association was found between the number of EHI risk factors and the volume of fluid intake after practice, with higher intake associated with more symptoms (*rho* = 0.197, *p* = 0.043). In those participants who reported generally better physical fitness (*rho* = -0.206, *p* = 0.030), significantly fewer EHI symptoms were noted. For those participants who reported consuming more fluids before practice (*rho* = 0.313, *p* = 0.001), and consuming fluids a longer time prior to practice (*rho* = 0.253, *p* = 0.009), the number of EHI symptoms were significantly greater.

An analysis to determine whether there are any significant correlations between EHI risk factors (any vs. none) and type of sport (football vs. rugby), being underweight (BMI < 18.5), illness on day or two weeks prior to data collection, drinking any fluid before practice (yes vs. no) and belief that you can drink too much (yes vs. no or not sure) was calculated using Pearson chi-square test. No significant associations were found. A similar set of analyses was conducted to determine

whether there are relationships with self-reported EHI symptoms (any vs. none). Again, no significant relationships were observed.

The self-reported presentation of muscle cramping during training was the only symptom category of EHI. Therefore, to determine associations with the prevalence of muscle cramping during practice, a series of comparative analyses were conducted. T-tests (Table 4.10) were conducted to compare muscle cramping with age, BMI, level of general physical fitness, how long before practice fluids were consumed, and the volume of fluid intake before, during and after practice.

Table 4.10: T-tests by muscle cramping during practice

	Muscle Cramping							
	No			**Yes**				
	N	***Mean***	***SD***	***N***	***Mean***	***SD***	***t***	***p***
Age	94	14.09	2.08	17	13.82	2.24	0.47	0.639
BMI	**94**	**20.74**	**2.47**	**17**	**22.64**	**3.54**	**-2.71**	**0.008**
General physical fitness	**94**	**1.71**	**0.73**	**17**	**1.12**	**0.60**	**3.18**	**0.002**
Fluid intake								
Length of time before practice	90	0.58	1.04	15	0.60	0.99	-0.08	0.939
Volume before practice	90	0.62	1.32	15	0.53	1.13	0.25	0.806
Volume during practice	94	2.10	1.45	17	2.18	1.19	-0.22	0.828
Volume after practice	89	0.64	1.31	17	0.47	1.07	0.50	0.615

As shown in Table 4.10, participants who reported muscle cramping had significantly higher body mass indices (t = -2.71, p = 0.008) and significantly poorer general physical fitness (t = 3.18, p = 0.002).

Finally, Pearson chi-square analyses comparing muscle cramping with type of sport (football vs. rugby), being underweight (BMI < 18.5), drinking any fluid before practice (yes vs. no) and the belief that you can drink too much (yes vs. no or not sure) did not reveal any significant correlation.

Table 4.11: Self-identified EHI symptoms versus Self-reported previous EHI diagnosis

		Current EHI symptoms (muscle cramps)		
		No	**Yes**	**Total**
Previous History	No	86	16	102
		84.3%	15.7%	100.0%
	Yes	8	1	9
		88.9%	11.1%	100.0%
	Total	94	17	111
		84.7%	15.3%	100.0%

Of the nine participants who reported a previous diagnosis of EHI, only one reported experiencing current EHI symptoms (namely, exercise-associated muscle cramps). A one-sided Fisher's exact test showed no significant relationship (p = 0.585). This test demonstrate the correlation of the variable, previous diagnosis of EHI, to current self-reported EHI category of exercises-associated muscle cramps. In the literature there is considered a causal relationship between previous diagnosis and risk for development of EHI. Thus the one-sided Fisher's exact test facilitate identification of significance in this small sample size.

A series of chi-square analyses were conducted to determine whether EHI symptoms (any vs. none) or reported cramping (yes vs. no) were more prevalent for any particular training date or starting time, and whether the duration of training (either 75 or 90 minutes) made a difference in the number of EHI symptoms reported. No significant correlations were observed.

4.10 Summary

A response rate of 22.4% (n= 111) was obtained, 49 union rugby and 62 football participants were recruited from a total of 500 players that initially attended the information session. The main findings of the study include: 19 % (n=21) of participants self-reported EHI risk factors; 14.4% (n= 16) of participants' self-reported exercises-associated muscles cramps, which was the only EHI symptom category, and 10.8% (n= 12) of participants did not report any EHI symptom. Fluid

was consumed by 94.5% (n= 105) before training, 100% (n= 111) during training, and 100% after training. Water was the most abundant fluid consumed before (86%, n= 91), during (94.5%, n= 105) or after (55%, n= 61) training. Many participants (77.5%, n= 86) indicated that they are knowledgeable if they consumed too much fluid. Beside fluid provided by the two football clubs, no other side-line support measures were noted. Poorer general physical fitness was associated with more EHI symptoms (*rho* = -0.211, *p* = .026). An additional significant association was found between the number of EHI risk factors and the fluid intake volume after practice, with higher intake being associated with more symptoms (*rho* = 0.197, *p* = .043). In those participants who reported generally better physical fitness (*rho* = -0.206, *p* = .030), significantly fewer EHI symptoms were noted. For those participants who reported consuming more fluids before practice (*rho* = 0.313, *p* = .001), and consuming fluids a longer time prior to practice (*rho* = 0.253, *p* = .009), the number of EHI symptoms were significantly greater. There were no significant associations between self-reported EHI risk factors (any vs. none) with self-reported EHI symptoms (any vs. none).

Chapter 5: Discussion

5.1 Introduction

This was the first study in the United Arab Emirates to determine the vulnerability of adolescent sports participants to exertional heat illness. The main findings of the study was that: 19 % of participants self-reported EHI risk factors; 16% of participants self-reported exercises-associated muscles cramps, which was the only EHI symptom category (refer to Table 2.4 and Table 3.1) and 12% of participants did not report any EHI symptom (refer to Table 2.4 and Table 3.1). Water was the most abundant fluid consumed either before, during or after training. Many participants (77.5%) indicated that they are knowledgeable about consuming too much fluid. No other side-line support measures, except fluid provided by both football clubs which was noted.

The results of this study can be considered valid as the questionnaire and symptom category measurement tool achieved agreement in face validity as considered by the experts invited to participate in the process. Gallagher, Needleman, Ashley, Sanchez and Lumsden (2017) argued that content validity to include a description of clear measurement aim(s), target population, item selection and concepts measured. The methodology of the validation process for the questionnaire and symptom category outcome measures included aforementioned aspects. The validity of the BMI and International fitness scale has been demonstrated.

The actual data collection occurred within a four week period after the information session, which facilitated the understanding of the questionnaire and data collection. Data collection of self-reported symptom categories and completion of questionnaire occurred immediately prior and after the training session. This process of collection reduced the recall bias.

Clarsen and Bahr (2014) require that the minimum number of participants to be 50 and minimal important change and smallest detectable be reported with standard error of measurement. This study exceeded the minimum number of required participants.

5.2 Selected risk factors

Poor general fitness (*rho* = -0.211, *p* = 0.026) and higher volume of fluid intake (*rho* = 0.197, *p* = 0.043) demonstrated a significant correlation with EHI symptoms (exercise-associated muscle contractions only). A comparison to other studies (Chung & Pin, 1996) is difficult as the criteria values defining obesity and physical fitness are different from the current study. Another problem is that the study populations (Gardner et al, 1996) in published studies are very different from those in this study, as no other studies reported on adolescents.

In a case-control study by Chung et al (1996), in a military environment, it was found that the odds for development of EHI are 4.29 for obese trainees with a BMI above 27 kg/cm^2. Though the population group was different, there are no differences between adult and youth risk factors. However, the environment in the Chung et al, (1996) study was different as the intensity of exercise are generally more intense in a military environment A greater risk for development of EHI was shown in marine recruits with a BMI above 22 and completing a 1.5 mile in 12 minutes or longer (Gardner et al, 1996). As argued earlier, the interpretation of BMI is dependent on reference standards used. According to the current study, BMI above 22 is not considered obese. The author is not aware of correlation studies of fitness levels between adolescents and adults for the 1.5 mile run. It should also be noted that during any military fitness testing, the military personnel usually have extra weight on persons' self in terms of equipment when the fitness testing is completed. The question becomes whether or not the findings can be extrapolated to the adolescent population. There are also dated studies used as references for supporting obesity (Knochel, 1989; Nadel, Wenger, Roberts, Stolwijk & Cafarelli, 1977) and poor physical fitness (Levin, 1993; Hanson & Zimmerman, 1979) as risk factors. The use of dated studies to support risk factors suggest that no new evidence has become available, irrespective of updates to recommendations were made. The study by Noakes et al. (1991) demonstrated increased metabolic heat production with increased core temperature to dangerous levels within 20–30 minutes in those who are unfit, obese or un-acclimatised. There are no known studies correlating the risk factors to diagnosing EHI in the adolescent population.

There are no reference to certain medication or medical conditions as risk factors in the latest National Athletic Trainers Association (2015) position statement as compared to the previous

position statement (National Athletic Trainers Association, 2002). None of the participants in this study noted any medication or medical conditions associated with EHI. The findings would support the omission from the new position statement. In the Cleary (2007) review on predisposing risk factors, emphasis was placed on obesity, fitness and acclimatisation. There was mention of some medications (i.e., antihistamines, diuretics or some dietary supplements) however, no reference was provided to support these risks. The importance in knowing if adolescents use medication has implications for amateur clubs, more so as they cannot afford medically trained personnel to understand the implications. The implications are that personnel need to be aware and understand the effect of the medication and why the medication is specifically required. Thus the safety aspect of the player is more important. The adolescent group is very impressionable regarding the effect of medication or any supplement use can have on performance. This would help the club to ensure that educational programmes ensure that this group of players are even better educated as to both the positive and negative effects of all supplements.

In National Athletic Trainers Association (2012) position statement on prevention of sudden death in sports, the evidence for support of recommendations in EHS regarding identification of risk factors are those classified as category C (Table 2.1, page 6). Also in National Athletic Trainers Association (2015) position statement on EHI, the evidence to support the identification of risk factors as a preventative measure, have the same evidence support category C. This category, according to SORT (Ebell et al, 2004), represents recommendations based on consensus, usual practice, opinion, or case series. The lack of better/higher quality evidence, questions the validity of the recommendation for the need to identify risk factors. If our evidence base does not support our ability to correctly identify risk, this could lead to wasting time and resources that will not ensure reduction in incidence or prevalence of EHI as we cannot reliably address prevention. There is a suggestion that EHI can occur without any risk present, as a single study demonstrated 50% of EHI cases without any identifiable risk noted (American College of Sport Medicine, 2007). Cleary (2007) advocated that certain objective measures are available to assist in identifying those with inherent risk factors. However, in her evidence evaluation she stated that there are not sufficient support for some of the recommendations, e.g. BMI above 22kg/cm^2 and a 1.5 mile run above 12 minutes, which refers to research in Marine recruits. Dougherty, Chow, and Kenney (2010) advocate different guidelines for lean and obese heat-acclimated boys as there study found a positive correlation between an increases in core temperature in more obese boys

when training in different environmental heat stress conditions. This would suggest that there is a need to generate more evidence that can be used with confidence to formulate evidence based guideline recommendations.

The results of the side-line check list identified that there was no equipment available to measure WBGT, or rectal temperature, nor was there an emergency action plan was available at any of the training sessions for any of the clubs. When WBGT rises above 28 degrees, there is an increased risk of EHS (Assia, Epstein & Shapiro, 1985). This lack of equipment identified in the current study would suggest that participants are at greater risk of EHS development or poor management in the case of EHS. If equipment was available, e.g. a rectal thermometer would help to diagnose EHS which has an agreed management approach. A possible suggestion to encourage the purchase of the required equipment, is to increase the club's understanding of the morbidity and mortality associated with poor management of EHS. Casa, Armstrong, Ganio and Yeargin (2005) collated the various cooling treatment options and rates of different cooling methods for EHS and found ice-water immersion to be most effective. However in the current study, none of the training sessions had sufficient cooling methods as noted via the side-line check list. There is agreement (National Athletic Trainers Association, 2015; American College of Sport Medicine, 2007) on how EHS should be managed, the insufficient cooling methods suggest a lack of knowledge in treatment of EHS, the more severe form of EHI

The above simply highlights the confusion in deciding the importance of identifying the risk factors in clinical reasoning and who to monitor during training sessions or games, possibly resulting from the lack of high quality evidence. A lack of sufficient evidence to support the risk factors, could resulting reduced vigilance in observations of those players that might be a greater risk for developing EHI. The possibility also exist that resources will not be used most effectively as time and money will be spend on education of the first-aiders that does not impact safety of players. The overall consensus in management of EHS, which is the most severe category of EHI, lays the foundation in the ability of administrators to prepare appropriately for such an incident.

The more objective risk factors, e.g. WBGT and dehydration status was not measured due to logistical and financial restrictions. These measures will arguably not be feasible to measure routinely in the context of the UAE due to afore mentioned reasons. This finding is also reflective

of the amateur environment in which the study took place. Thus the selected risk factors are a reflection of actual environment of the amateur club.

5.3 Self-reported EHI symptoms

The only self-reported presentation in the current study was that of acutely painful and involuntary muscle contractions. This presentation represents the symptom category of EAMC within this umbrella term of EHI (refer to section 3.7.1, Table 3.1). Unfortunately, no prevalence rate for the current study was determined as the study occurred only for a period of one training session Philips (2000) suggested that a diagnosis should be made by a doctor or physiotherapist with consistency in set of codes for site, nature and severity of injury. Therefore in the current study no actual diagnosis was made, but rather self-reported symptoms was provided by participants. Further argument by Philips (2000) is that a true injury picture is not provided as reported data on effects of injuries are only given for games and exclude training injuries. The nature of the study design did not allow for outcome evaluation as a result of self-reported symptoms by participants.

With only 16 of a total sample of 111 participants self-reporting EHI symptoms, an incidence rate of 14.4% was identified in the current study. An incidence of 1.2 cases of EAMC per 1000 entrants was noted, with cramping accounting for 6.1% of medical encounters in a 12 year observational study of marathon medical encounters (Roberts, 2000). The same Roberts' study (2000) suggested that there has not been large enough epidemiology research within the EACM symptom category to establish a proper incidence rate. According to American College of Sport Medicine (2007) there is a lack of data regarding the incidence of EHI in an athletic population or over any prolonged period of time, referring to incidences determined at individual athletic events. This is the difficulty in that the activities within the research are different, thus there should be caution in drawing comparisons in either the incidence or prevalence to help determine if this is of clinical importance in rating the response required when identifying the symptom(s).

Heat acclimatisation is suggested to occur over a 14 day period (Casa, 2009). As the study took place four weeks after the start of the season, there might have been some form of acclimatisation already occurring. This could possibly have contributed to the lower number of EHI symptoms that have occurred in the study.

In their response to the Wilderness Medical Society's practice guidelines (Lipman et al, 2013), Joslin et al. (2014) argues that there was a lack of updated research for the guidelines presented, considering some guidelines not to be current. This new terminology or current concepts would support the low number of EHI identified as well as the lack of more serious categories of EHI.

5.4 Hydration practices

According to the self-reported hydration practices (Table 4.7) in the current study, the majority of participants indicated that they drank before (94.6%, n= 105), during (100%, n= 111) and after (100%, n= 111) training, with water the most abundant fluid consumed. The amount consumed before training in the current study was almost half the volume consumed in the research by Cleary et al. (2012) (between 400 – 800ml), where they investigated the effect of a single hydration education session on hydration behaviour. There is further difficulty in comparing fluid consumption of various studies, For example, Decher et al., (2008), referred to hydration status but did not indicate whether consumed fluid volume was measured, and how this consumed volume related to hydration status.

Recommendations by National Athletic Trainers Association (2015), American Academy of Paediatrics (2011), and American College of Sport Medicine (2007) all suggested individually designed hydration programmes, with fluid composition inclusive of electrolytes and carbohydrates (American College of Sport Medicine, 2007). National Athletic Trainers Association (2015) does not advise a specific volume or composition and American Academy of Paediatrics (2011) emphasize sodium to encourage rehydration. This lack of clarity especially in an amateur environment, where there is no support in helping players to determine own hydration programmes or fluid and electrolyte losses, could reflect the variations in volume of fluid drank.

National Athletic Trainers Association (2015) recommends fluids sufficient to replace fluid lost during training, which they suggest should be no more than 2% of body weight lost during training (measured body weight before and after training). The American Academy of Sport Medicine (2007) recommends full replacement of electrolytes and fluids lost, with enough sodium. The American Academy of Paediatrics (2011) does not advise any fluid use after training. With just over 34% (n= 37) of participants noting that they consumed a sports drink after training, this again

highlights a possible lack of knowledge or awareness in any of the recommendations. Both the type of fluid and the varied volume consumed indicate either a lack of knowledge or understanding in how to determine fluid and electrolyte loss following training. Added to the differences in recommendations by different organisations, there is bound to be some confusion.

5.5 Knowledge of over-hydration and recognition

A total of 77.4% (n= 86) of participants reported knowing that a person can drink too much. The following reasons were given in support: A heavy feeling, a stitch or feeling bloated, a full tummy, frequent urination, feelings of water sloshing or moving in tummy, light coloured/clear urine, needing to use a toilet and a feeling that they can't drink anymore. There were 3.6% (n= 4) of participants who were not sure and no reason was provided by 10.8% (n= 12) of participants. To the knowledge of the author, no previous studies have evaluated whether adolescent sports players were aware of drinking too much and how to recognise if they do, with Decher et al., (2008) evaluating the knowledge and behaviour regarding hydration before and during training.

There is increased morbidity and mortality associated with hyponatremia, which is a considered a common electrolyte disorder with a serum sodium level lower than 135 mmol/L (Hoorn & Zietse, 2013). Following changes to guidelines, *ad libitum*, in fluid consumption there was a reduction in incidence of exercises-associated hyponatremia (Noakes, 1992; Noakes et al., 1988). Over-hydration is considered a primary contributor to the development of exercise-associated hyponatremia. At the consensus statement meeting (Hew-Butler et al., 2005) on exercises-associated hyponatremia, it was noted that athletes can present with or without symptoms such as nausea, lethargy, confusion, seizures or altered mental states. Exercises- associated hyponatremia seems to be mostly noted in endurance athletes (Speedy, Noakes & Schneider, 2001). Rosner and Kirven (2007) considers the non-specific nature of some of the considered symptoms associated with exercises-associated hyponatremia to be part of the problem in that it cannot be distinguished from other conditions.

It does appear that none of the participants could recognise if they actually drank too much. As indicated above, this inability to recognise if too much fluid has been consumed can be very dangerous. This could also be confusing for the coaches or other support staff to be able to

recognise if a player is developing exercise-associated hyponatremia, especially in multi-day events or training sessions. These findings indicate the need for context specific tailored educational interventions.

5.6 Associations between risk factors and EHI symptoms

Poorer general physical fitness was associated with more EHI symptoms (EAMC, only), which is to be expected, since one of the EHI risk factors is poor physical fitness. In those participants who reported generally better physical fitness, significantly fewer EHI symptoms were noted (refer to Table 4.3 in results). This association compares to published research as better physical fitness is not a risk factor for EHI. Piwonka, Robinson, & Manalis, (1965) demonstrated that an individual's ability to tolerate heat stress improves with an increase in VO2 Max, independent of acclimatisation and heat adaptation. Thus suggesting that a physically fitter player would have better thermoregulatory ability as compared to an unfit player and therefore have a reduced risk to development of EHI.

An additional significant association was found between the number of EHI risk factors and the volume of fluid intake after practice, with higher intake associated with more symptoms (*rho* = 0.197, $p = 0.043$). For those participants who reported consuming more fluids before practice (*rho* = 0.313, $p = 0.001$), and consuming fluids a longer time prior to practice (*rho* = 0.253, $p = 0.009$), the number of EHI symptoms were significantly greater. National Athletics Trainers Association (2015) and American College of Sport Medicine (2007) considers dehydration a risk for developing EHI, however, inferring that increased fluid equals improved hydration. The current study does not support this extrapolation as EHI symptoms were significantly more. As noted in the side-line support list, two clubs (football) provided extra water and most participants noted that they drank before, during and after training, which would suggest that the dehydration level within the study sample was possibly very low.

The reported muscle cramping during training is the only indication of EHI, whereas the other self-reported EHI presentations did not meet the criteria for heat exhaustion and therefore EHI. This finding demonstrated that those who reported muscle cramping had significantly higher body mass indices and significantly lower general physical fitness. This simply correlates to both higher BMI and lower general fitness levels to be known risk factors (National Athletic Trainers

Association, 2015; American College of Sport Medicine, 2007). Even though both lower general fitness and higher BMI result in reduced thermoregulation, there is not conclusive agreement whether increased metabolic heat (increased core temperature) results in EHI (Horswil, Stofan, Lovett & Hannasch, 2008).

The next chapter will consider the conclusion and limitations to the study, as well as recommendations applicable to this amateur environment.

Chapter 6: Conclusion, Limitation, Recommendation

6.1 Conclusion

The results demonstrated that 19% of participants presented with self-reported EHI risk factors while only 14.4% of participants self-reported EHI symptoms (EAMC only). This study's findings imply that slightly less than one in five participants are vulnerable to develop EHI in this sample of adolescents in the UAE. In addition, these amateur clubs lack adequate preparation to prevent, recognise and treat severe EHI episodes. This is demonstrated through the lack of any emergency action plans available, which would outline the organizations' management inclusive of prevention, recognition and treatment of all the different forms of EHI. The self-reported hydration practices suggest that the participants do consume sufficient fluids, though not always according to guideline recommendations. As a result participants have a possible increased risk for the development of hyponatremia as they cannot self-identify when they consumed sufficient fluid or support staff to identify whether a participant is developing hyponatremia as a result of the non-specificity in the presentations associated. Further research is needed that would be reflective of the amateur environment in which these guideline recommendations should be applied. This would allow for the more specific identification and suggestions on addressing barriers to application of guideline recommendations within this amateur environment.

6.2 Limitations

The study design limits the extrapolation, in that only self-reported risks and symptoms were reported. Though the outcomes were interesting, duplication of research is needed to ensure that both results and conclusion are valid. A quantitative study, using multiple researchers and settings, which looks at different variables involved with EHI, will allow for accumulative larger sample sizes.

The limitation of the low response rate and consequently the small sample size resulted in a study that was under-powered. Possible mitigation for a low response rate would be to ensure that after ethical approval, there would be sufficient time for canvasing and to arrange face to face meetings with club management.

Furthermore there is a lack of reliability for the newly developed questionnaire. Though face validity of the questionnaire was established, the responses obtained was not correlated to objective measures. Researchers need to discus with biostaticians, during outcome development process, possible means of increasing the reliability.

The lack of Arab speakers, indigenous to the region, did not allow for any comparison to determine if longer, from birth, exposure to the environmental condition would have an influence on the incidence of EHI.

5.3 Recommendations

As highlighted by the differences in opinion by the various authors in defining EHI, a need exist to reach consensus on the definition and terminology of terms used within EHI.

Due to the variety of evidence used to support the various recommendations a need exist for sporting organizations to have sport and population specific (adolescents, adults, male, female) recommendations based on research evidence within the specific sport.

There is a need for advocating and explaining the need for emergency action plan (EAP) in order for sporting organisations to be prepared for EHI which could minimize the known morbidity and mortality associated with especially EHS. Further facilitating the minimizing the risk for development of EHI is the advocating for the adoption of current heat acclimatisation recommendations.

If considering the environmental factors and the perceived lack of structured acclimatization, there is an increased need for research within the Middle East amongst the adolescent sporting population within the context of amateur sport.

Numerous authors have provided various incidence rates and with the associated morbidity and mortality, evaluating the effectiveness of the application of preventative recommendations on the outcome in either the incidence or prevalence rate or morbidity and mortality associated with a diagnosis of EHI is needed. This will allow for evidence to support prevention measures currently recommended

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Appendix A: Letter of Introduction

DATE

Club Name

Parents and players falling within the 10 – 19 year age group.

Consent for participation in research on vulnerability to exertional heat illness in Dubai.

Practicing sport in the Dubai environment lends itself to development of Exertional Heat Illness, if not managed properly can have adverse consequences. Exertional Heat Illness is defined as symptoms ranging from heat cramps, light headedness or fainting (syncope) to exercise exhaustion, heat stroke and hyponatremia (less salts in body). Although Exertional Heat Illness mostly develop in hot & humid environments, it has been found to develop in cooler environments as well. Dehydration is a significant risk factor in the development of Exertional Heat Illness.

As the consequences of exertional heat illness result in significant damage, it is important to be able to determine if this occurring and how best to manage this condition.

Following communication with club management, we would appreciate if you could assist us in determining how many players are vulnerable to development of exertional heat illness during a training session. We would also like to determine how much fluid is used, what kind of fluids are used and why these fluids are used.
Participants will be free to withdraw their consent to participate in the research at any point through communication with the club. This will minimise any contact with researcher during the process of research.

The purpose of the research is to identify how vulnerable adolescents are to development of exertional heat illness. The results will be used to ensure that players train in as safe an environment as possible. Thus it is hoped that the results will be used to develop guidelines or advise on practices to minimise the risk for the development of exertional heat illness. We will thus be able to advise or recommend to the club as to content of educational programmes.

The research will be conducted in the following manner, with permission of the Medical Research Committee of Dubai Health Authority and University of Stellenbosch in South Africa.

Information and discussion session on research and process, time to be arranged and agreed.

Distribution of consent (for parents) & assent (players) forms.

Collection of signed consent from: Parents & players, 10 – 19 year old

Distribution of research questionnaires (two), prior to start of training session.

Collection of the following data prior to training session, height and weight.

Collection of research questionnaires, immediately following training session.

Collection of the following data, weight measurement after training.

Reporting of results to clubs. Recommendations send to club to enable the development of appropriate content for educational programmes.

Andre Heynes
Research student

Appendix B: Participation Information Leaflet and Consent Form

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM

TITLE OF THE RESEARCH PROJECT:
THE VULNERABILITY OF ADOLESCENT SPORTS PARTICIPANTS IN DUBAI TO EXERTIONAL HEAT ILLNESS IN DUBAI, UAE.

REFERENCE NUMBER:

PRINCIPAL INVESTIGATOR: Mr Andre Heynes

ADDRESS: Physio Art Physiotherapy Center, Jumeirah Beach Park Plaza, Dubai

CONTACT NUMBER: +971 50 943 4143

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the physiotherapist any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the **Health Research Ethics Committee at Stellenbosch University** and **Dubai Health Authority Research Committee** and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?
The aim of study is to determine if our youth (10-19 year olds) players, your child, are vulnerable to development of Exertional Heat Illness. Exertional heat illness is a condition that develops at the start of the season, in hot and humid environmental conditions, when athletes are un-acclimitized, dehydrated and unfit. The condition varies form muscle cramps, fainting spells, heat exhaustion to more serious and dangerous exertional heat stroke. If exertional heat stroke is not diagnosed early or treated correctly, this can lead to organ damage and even death.

The study will be conducted at venue of the training session. The study will be done during one (1) training session only, at the start of the new season. The study duration will be 3 weeks,

however each participant will only be part of the study on one day, irrespective of them attending more than one session over the 3 week period. There will be other sites (different clubs) taking part in this study. However for logistical reasons, the participant can only attend his or her training session at his club and not at any other site. We will attempt to recruit each registered player at all the different clubs offering rugby and soccer. The projected number of participants is 2500 form all clubs.

We will arrange an introductory session with both parents and children at the club to explain exactly what will occur during the study. The introductory session will occur at a time agreed upon. Following this, consent and assent forms will be distributed. Consent forms will be collected on the day of the introductory session or on day of study, prior to training starting.

The study will actually be conducted over the course of a training session. However two (2) questionnaires will have to be completed, one before and one after the actual training session. These questionnaires will be provided and collected by the principal investigator and assistants. Each participant's height and weight before training and weight again after training will be collected. Weight measurements will be done in shorts and t-shirt, without any socks and training boots. Height measurements will be done without participant wearing and training boots or footwear. Measurements taken will be noted by assistant and not verbalized or given to participant in confidential manner.

No medication will be administered during any part of this study.

Why have you been invited to participate?
We know that in the United States of America, this condition occur more in the 10-19 year age group. The information gained during this study will help to direct what sort of training clubs have to obtain in order to ensure that each athlete will be able to practice their training in a safe environment.

What will your responsibilities be?
We expect of you to attend the agreed information session with your child in order to ask any questions in ensuring that you understand the purpose of the research in order to either consent or decline for your child to participate in this study. Once you have signed the consent form for your child to participate, we expect you to inform us if you decide to withdraw prior to or on day of the actual study. If you wish to continue after signed consent has been provide, we would expect that you ensure that your child is available for the agreed training session, bar any incidents.

Will you benefit from taking part in this research?
The benefits will be exclusively for your child or any adolescent athlete participating in sport.

Are there in risks involved in your taking part in this research?
There is no risk to you or your child.

Who will have access to your medical records?
Confidentiality during the actual study process cannot be guaranteed as information sessions will be held in groups and measurements during training will be gained at the training venue. However results of measurements will be confidential and no further reference to participant will be made in either analysis of results, or when writing up dissertation. Data will be anonymised by assigning a serial number for each participant.

The research team, including my supervisors from the Stellenbosch University in South Africa will have access to the information gained. The clubs will receive a list of recommendations and suggestions dependent on the outcome of the information gained.

What will happen in the unlikely event of some form of injury occurring as a direct result of your taking part in this research study?
We do not expect any injury as result of the study. However if the need arise to deal with any injury during the training session, this will take priority and be dealt with via normal channels of assistance.

Will you be paid to take part in this study and are there any costs involved?

No you will not be paid to take part in the study but your transport. There will be no costs involved for you, if you allow you child take part.

Is there any thing else that you should know or do?

- You can contact Prof Quinette Louw at tel. +27 if you have any further queries or encounter any problems.
- You can contact the Health Research Ethics Committee at 021-938 9207 if you have any concerns or complaints that have not been adequately addressed by your study leader.
- You will receive a copy of this information and consent form for your own records.

Declaration by participant

By signing below, I ……..……. agree to allow my child to take part in a research study entitled THE VULNERABILITY OF ADOLESCENT SPORTS PARTICIPANTS IN DUBAI TO EXERTIONAL HEAT ILLNESS IN DUBAI, UAE.

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.

- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the study doctor or researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) .....…..……. on (*date*) ……...…….. 2005.

....
Signature of participant **Signature of witness**

Declaration by investigator

I Andrre Heynes declare that:

- I explained the information in this document to ……..
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use a interpreter. (*If a interpreter is used then the interpreter must sign the declaration below.*

Signed at (*place*) .....…..……. on (*date*) ……...…….. 2015.

....
Signature of investigator **Signature of witness**

Declaration by interpreter

I *(name)* ……..…… declare that:

- I assisted the investigator (*name*) ……. to explain the information in this document to (*name of participant*) ……..…….. using the language medium of Arabic.

- We encouraged him/her to ask questions and took adequate time to answer them.
- I conveyed a factually correct version of what was related to me.
- I am satisfied that the participant fully understands the content of this informed consent document and has had all his/her question satisfactorily answered.

Signed at (*place*) .....….....…….. on (*date*) ……...……..

....

Signature of interpreter **Signature of witness**

Serial no:

Appendix C: Stellenbosch University Assent Form

	STELLENBOSCH UNIVERSITY **FACULTY OF HEALTH SCIENCES**	

PARTICIPANT INFORMATION LEAFLET AND ASSENT FORM

TITLE OF THE RESEARCH PROJECT: *Vulnerability of adolescent sports participants in Dubai to exertional Heat Illness*

RESEARCHERS NAME(S): Andre Heynes

ADDRESS: **Physiotherapy Department, University of Stellenbosch**

CONTACT NUMBER: 00971509434143

What is RESEARCH?

Research is something we do to find new knowledge about the way things (and people) work. We use research projects or studies to help us find out more about disease or illness. Research also helps us to find better ways of helping, or treating children who are sick.

What is this research project all about?

We would like to evaluate how many players think they may have signs of exertional heat illness during a normal training session present & to see how much fluid they drink or when they drink & what they drink.

Why have I been invited to take part in this research project?

In the United States of America there is evidence that heat illness can cause serious health problems. They have found that the majority of athletes are of the same age group as what you are. However with all the advice available at moment, adolescents are still diagnosed with this heat illness

Who is doing the research?

I am Andre Heynes, a physiotherapist involved with both rugby & soccer. I would like to know how many adolescents present heat illness. This will help us to give appropriate advice on fluid use and what clubs need to be doing to ensure that training will be safe.

What will happen to me in this study?

During the study you will be required to complete two (2) questionnaire. This will give us some information about you, how much fluid you drink, what fluids you drink & when you drink. The questionnaire to be completed before and after normal training. Before training we will take weight (before & after training) & height measurements.

To determine if you present with symptoms of heat illness, the questionnaire will have these listed for reference. Thus all you have to do is complete normal training. Following completion of the training.

Can anything bad happen to me?

Though we are not looking at treatment for heat injury, a serious injury is heat stroke. During heat stroke your body temperature increase significantly. This can cause serious problems, even death if we don't treat this appropriately.

Can anything good happen to me?
The information gained will help the club to provide advice about fluid use, if training/games should continue or what educational programmes is need for the volunteers.

Will anyone know I am in the study?
Your parents & volunteers will know that you are part of the study. We cannot guarantee that your participation will be confidential as the study will take place in an open/club environment. We can however guarantee that the information gained will be confidential.

Who can I talk to about the study?
Andre Heynes: andreh.cooper@gmail.com
Quinette Louw: qalouw@sun.ac.za
Dawn Erntzen: dd2@sun.ac.za
Sunita Potgieter; sunita@sun.ac.za

What if I do not want to do this?
You are free to stop being part of the study at any time. Even if your parents have agreed to you partaking in the study, you can still inform us that you do not wish to take part in the study.

Do you understand this research study and are you willing to take part in it?

YES NO

Has the researcher answered all your questions?

YES NO

Do you understand that you can pull out of the study at any time?

YES NO

_____ _____
Signature of Child Date

Serial No:

Appendix D: Vulnerability and Hydration Questionnaire

Vulnerability and hydration practices questionnaire

Please complete the following

Sport:	**Today's Date**:
Gender:	**Date of Birth**:
Training- start time: -duration:	**Medication, Please circle:** Antiepileptic agents, Anticholinergic agents, Decongestants, Diuretics, Beta blockers, others
Medical conditions: **Please circle:** Cystic Fibrosis, Scleroderma, Sickle Cell Trait, Malignant Hyperthermia, Arteriosclerotic Vascular Disease, Neuroleptic Malignant Syndrome	
Any previous episodes of exertional heat illness, please select No ☐ Yes ☐ en (date)	

1. Any illness today, flu, runny tummy

_____

2 Any illness over last 2 weeks, please note:

_____

3 Any injuries over last 2 weeks

No ☐ Yes ☐ what injury_____what treatment_____

Please complete the following regarding drinking fluids:

3.1 Do you drink fluids before training

No ☐, Why not? _____

Yes ☐, What kind of fluid? _____

, How much do you drink? _____

, How long before training do you drink? _____

3.2 Do you drink during training?

No ☐, Why not? _____

Yes ☐, What kind of fluid? _____

, How much do you drink? _____

3.3 Do you drink after training?

No ☐, Why not? _____

Yes ☐, What kind of fluid? _____

, How much do you drink? _____

4 Can you drink too much, and how do you know if you drank too much?

_____

5 Height:

6 Weight, Before training:

After training:

Serial No:

Appendix E: Self-Reported symptoms for exertional heat illness

Exertional Heat Illness Symptom Identification

Did you experience any of the following during training just completed?

Please circle the applicable

SYMPTOMS	SYMPTOMS
Acute, painful and involuntary muscle cramps	Unable to stand or walk on own because of light-headedness
Unable to continue, except for injury	Heavy sweating
Very Pale skin	Prickly heat sensation
Headaches	Abdominal cramps
Nausea	Vomiting
Diarrhoea	Persistent muscle cramps not as result of injury
Collapse	Irrational or unusual behaviour
Drowsy	Disoriented, confused,
Inappropriate comments	Irritable

.

Serial No:

Appendix F: Validity assistance for two exertional illness outcome measurement tools

Date

Dear

Validity assistance of two Exertional Heat Injury outcome measures.

We would hereby like to extend an invitation, requesting assistance in determining the face validity of two outcome measurement instruments. These two instruments will be used to determine the vulnerability to exertional heat illness of adolescents participating in rugby union and football/soccer training session. The instruments will be used in a research project which is part of the requirements for an MSc (Thesis in Physiotherapy) at the Stellenbosch University, South Africa.

The instruments will be used for adolescents partaking in rugby union or football in Dubai, at the start of the new season of 2015/2016. We would appreciate if you would provide feedback to the research questionnaire and exertional heat illness symptom identification data sheet.

The purpose of the "**Vulnerability and hydration practices questionnaire**" is to elicit the known risk factors and self-identified hydration practices of adolescents in environmental conditions suitable to possible development of exertional heat illness.

The "**exertional heat illness symptom identification data sheet"** is based on American College of Sports Medicine (2007a) and National Association of Athletic Trainers (2002) definition. The purpose is to elicit self-reported symptoms, immediately following a training session.

Comments regarding the ability of the instruments in gaining the said information would be greatly appreciated.

Thanking you in advance for your time in reading and considering this request.

Kind regards,

Andre Heynes

Principal Investigator

Email: andreh.cooper@gmail.com

Appendix G: Feedback from respondents to request for validity assistance

Sebastien Racinais
Dear Andre,

Your initiative sound good. My only comments would be to get somebody (e.g. parents) with the adolescents to help them filling the 'Vulnerability and hydration practices questionnaire'. I guess that this one will be filled only once as it refers to general practice, whereas the symptom list should be filled after each training / competitions.

Best regards,

Sebastien

Sebastien Racinais
Head of Research Operations — Office: +(974) 4413 2544
Athlete Health and Performance Research Centre — P.O. Box 29222
Aspetar — www.aspetar.com

Prof Casa

Great Job Andre. The biggest suggestion I have is making it more reader friendly by asking questions instead of statements like "Any illness today", etc. Also I encourage you to consider the do/did tense and make sure it is consistent throughout. The tense you use will depend on your purpose (do you normally in your training sessions, or did you for this specific one).

Prof Casa

Thank you for your feedback.

With regards to changing for example "Gender to Sex". I think that for this sample the word "gender is more frequently used in this environment. I also consider the 'statements ' to facilitate urgency in answering the question. I also think that he questions need to remain as short as possible.

Further to your suggestion of changing "do you drink …, to did you drink", I do understand your rational of getting to understand what they normally drink or if they did drink before during or after the training session. My rational is that the players know how much they usually drink and this would probably be more reflective of hydration practices. I am involved with the organisations that have shown interest in participating and have personal experience in players bringing the same relative volume and fluid type. I therefore think that keeping "do you drink" to be relative to this sample

Regards

Dear Andre

I acknowledge the reasoning for not amending the suggestions. The questionnaire will obtain the information that you seek.

Regards,

Prof. Douglas Casa
Korey Stringer Institute, University of Connecticut
2095 Hillside Road U-1110, Storrs, CT 06269
Office: 860-486-0265 Cell: 479-387-6220
Fax: 860-486-1123 Website: ksi.uconn.edu

Appendix H: BMI-for-age

Calculation of BMI-for-age and interpretation of outcomes.
Principal investigator will calculate BMI and interpretation is based on World Health Organization 2007 References

BMI calculation:
BMI = weight/height^2

Cut-offs	z-scores	BMI measurement
Overweight	>+ 1SD	25 kg/m^2
Obesity	>+ 2SD	30 kg/m^2

Modified from WHO 2007 References

Appendix I: Side-line support check-list

Side-line support check-list for Exertional Heat Illness

Sport:

Training date:

Training session time:

Support Item	Present or Absent
Rapid cooling equipment	
Shading	
Hydration fluids	
Equipment to measure WBGT	
Equipment to measure rectal temperature	
Ice	
Medical Trained Personnel	
Emergency Action Plan available at training	

Appendix J: The International Fitness Scale

The International Fitness Scale (IFIS)

It is very important that you do this test by yourself without taking into account the answers given by your team matess. Your answer is only useful for the progress of science and medicine. Please answer all the questions and do not leave any blank. Mark only one answer per question, and more important: be sincere. Thank you for your co-operation.

Please try to think about your level of physical fitness (compared to your friends) and choose the right option.

Your general physical fitness is:
Very poor
Poor
Average
Good
Very good

Your cardiorespiratory fitness (capacity to do exercise, for instance running, for a long time) is:
Very poor
Poor
Average
Good
Very good

Your muscular strength is:
Very poor
Poor
Average
Good
Very good

Your speed / agility is:
Very poor
Poor
Average
Good
Very good

Your flexibility is:
Very poor
Poor
Average
Good
Very good

THANK YOU FOR YOUR TIME AND PARTICIPATION

Serial No:

Appendix K: EHI vulnerability data capturing sheet

								EHI Vulnerability Data Capturing Sheet																																			
					Training		Medication							Medical Conditions						Previous Diagnosis of EHI					Fluid use before training					Fluid use during					Fluid use After Training								
Serial No	Sport	Todays Date	Gender	DOB	Start Time	Duration	Antiepetic	Anticholergic	Decongestants	Diuretics	Beta Blockers	Others		CF	SCT	MH	AVD	NMS		No	Yes & date	Illness today	Illness over last 2/52	No	Reason	Yes	What	Volume	How long before	No	Reason	Yes	What	Volume	No	Reason	Yes	What	Volume	Can you drink too much	Height	Weight Before	Weight After

Appendix L: The information session

The information session, for parents, players and club personnel

Agenda:

Welcome
The principal investigator greeted and welcomed the parents, players and club personnel that attended the session. The attendees were informed that they could ask questions at any time during the session.

Purpose of the session.
The background to the reasoning for the research was shared. The principal investigator explained the concepts of consent and assent and that signed consent and assent would be required from both parents and players. These forms were distributed at the end of the session to both parents and players and informed that the forms are identical to those that the club distributed during earlier communication. The principal investigator informed the parents and players that these forms were to be collected on the day of actual data collection.

The principal investigator explained the procedure for the actual data collection days. The parents were informed that the consent forms will be available on the day for signature. The players were also informed that they could sign the assent form on the day of data collection. This was to ensure that serial numbers correlated to parent and player.

The actual data to be collected was explained in detail. A concern for parents was how continuation of data collection will be ensured. They were asking how data capturing of weight after training will be noted on the correct questionnaire. It was decided that all consent and assent forms and questionnaires would be prepared in an envelope with the player writing his or her name on the envelope, Thus after training collection of envelop will ensure continuation of data collected.

The majority of parents and players wanted information on the medical conditions and medications within the questionnaire. The principal investigator explained the medical conditions and medication. The principal investigator emphasised that medical diagnosis can only be made by a physician and if they consider their children to have any of the symptoms of any of the medical conditions discussed, they should arrange a visit with their primary care physician.

The concept of anonymity was explained and due to the nature of the data collection, other participants and players will know that the players are taking part in the research. However, emphasis on ensuring data collected were not share with other players or either parents or club unless explicitly allowed by player.

Dates for data collection was confirmed for the month of October 2015.

Appendix M: Search Results

Number	Clearing House/ Database	Initial Hits	Eligible Titles	Duplicates	Excluded
1	The US National Guideline Clearinghouse (US NGC); Agency for Healthcare Research and Quality (AHRQ	1	National Athletic Trainers' Association position statement: preventing sudden death in sports. Casa DJ, Guskiewicz KM, Anderson SA, Courson RW, Heck JF, Jimenez CC, McDermott BP, Miller MG, Stearns RL, Swartz EE, Walsh KM. J Athl Train. 2012 Jan -Feb;47(1):96-118.	0	0
2	Guidelines International Network (G-I-N);	0			
3	Scottish Intercollegiate Guidelines (SIGN)	0			
4	United Kingdom's National Institute for Health and Clinical Excellence (NICE)	0			
5	New Zealand guidelines group (NZGG)	0			
6	WHO guidelines	0			
7	TRIP database	1	Specific Treatment Options - heat exhaustion and heat stroke Joint Royal Colleges Ambulance Liaison Committee2007, http://www2.warwick.ac.uk/fac/med/research/hsri/emergencycare/prehospitalcare/jrcalcstakeholderwebsite/guidelines/heat_exhaustion_and_heat_stroke_2006.pdf	0	1

8	National Institutes of Health (NIH)	0			
9	Monash University Centre for Clinical Effectiveness	0			
10	Australia's National Health and Medical Research Council (NHMRC)	0			
11	Canadian Medical Association Clinical Practice Guidelines Infobase	1	http://www.cps.ca/en/documents/position/sport-nutrition-for-young-athletes	0	1
12	Institute for Clinical Systems Improvement (ISCI)	0			
13	Cochrane	0			
14	PubMed; Medline, Web of Science	4	National Athletic Trainers' Association Position Statement: Exertional Heat Illnesses, Helen M. Binkley; Joseph Beckett; Douglas J. Casa; Douglas M. Kleiner; Paul E. Plummer, Journal of Athletic Training 2002;37(3):329–343 National Athletic Trainers' Association Position Statement: Exertional Heat Illnesses, Douglas J. Casa; Julie K. DeMartini; Michael F. Bergeron; Dave Csillan; E. Randy Eichner; Rebecca M. Lopez; Michael S. Ferrara; Kevin C. Miller; Francis O'Connor; Michael N. Sawka; Susan W. Yeargin Journal of Athletic Training 2015;50(9):000–000 doi: 10.4085/1062-6050-50-9-07 Inter-Association Task Force on Exertional Heat Illnesses Consensus Statement, Oded Bar-Or, Cantrill, W. Larry Kenney, Suzanne Nelson Steen, Kim Fagan, Rick Wilkerson, Phillip Zinni III, N. Sawka C. Dexter (Bo) Kimsey, Jr, John W. Gardner, Bob Murray, Bareket Falk, Christine Bolger Douglas J. Casa, Chair Jon Almquist, Scott Anderson, Michelle A Cleary, Ron Courson, Robert L. Howard, Michael Ryan, Chris Troyanos, Katie Walsh, Maria Dastur, Michael Barnes, Terrence Lee; www.nata.org/sites/default/files/inter-association-task-force-exertional-heat-illness.pdf	Updated version available	1

			National Athletic Trainers' Association position statement: preventing sudden death in sports. Casa DJ, Guskiewicz KM, Anderson SA, Courson RW, Heck JF, Jimenez CC, McDermott BP, Miller MG, Stearns RL, Swartz EE, Walsh KM. J Athl Train. 2012 Jan-Feb;47(1):96-118.		
15	SAGE	0			
16	Medline, Science Direct ArticleFirst, Ebsco, ProQuest	8	National Athletic Trainers' Association Position Statement: Exertional Heat Illnesses, Helen M. Binkley; Joseph Beckett; Douglas J. Casa; Douglas M. Kleiner; Paul E. Plummer, Journal of Athletic Training 2002;37(3):329–343 A systematic review of guidelines for the prevention of heat illness in community-based sports participants and officials. T Larsen ; S Kumar; K Grimmer; A Potter; T Farquharson; P Sharpe. Journal of Science and Medicine in Sport, 2007-02-01, Volume 10, Issue 1, Pages 11-26 Exertional Heat Stroke: Strategies for Prevention and Treatment From the Sports Field to the Emergency Department, Riana R. Pryor , Douglas J. Casa , Jolie C. Holschen , Francis G. O'Connor and Lesley W. Vandermark Clinical Pediatric Emergency Medicine, 2013-12-01, Volume 14, Issue 4, Pages 267-278 Heat acclimatization : preparing athletes to compete in hot environments, International SportMed Journal, 2000, Volume 1, Issue 2; Phillip B. Sparling Guidelines for the prevention of heat illness in community-based sports participants and officials John Rowland Brotherhood Journal of Science and Medicine in Sport, 2007-06-01, Volume 10, Issue 3, Pages 191-192, Copyright © 2007 Sports Medicine Australia Heat Can Kill: Guidelines to Prevent Heat Illness in Athletics and Physical Education, Nita Unruh, Scott Unruh & Ed Scantling Journal of Physical Education, Recreation & Dance Volume 73, Issue 6, 2002 Wilderness Medical Society Practice Guidelines for the Prevention and Treatment of Heat-Related Illness: 2014 Update Grant S. Lipman , Kurt P. Eifling, Mark A. Ellis , Flavio G. Gaudio , Edward M. Otten and Colin K. Grissom	0	4

			Wilderness & Environmental Medicine, 2014-12-01, Volume 25, Issue 4, Pages S55-S65 Heat-Related Illness: Time To Update Our Lexicon Jeremy Joslin, Joshua Mularella, Robert Worthing, Wilderness & Environmental Medicine Volume 25, Issue 2, June 2014, Pages 249–251		
17	EBSCO host	1	Heat acclimatization : preparing athletes to compete in hot environment**s,** International SportMed Journal, 2000, Volume 1, Issue 2; Phillip B. Sparling	1	1
18	CINAHL	0			
19	Web of Sciences; Medline; Pubmed	12	National Athletic Trainers' Association Position Statement: Exertional Heat Illnesses, Douglas J. Casa; Julie K. DeMartini; Michael F. Bergeron; Dave Csillan; E. Randy Eichner; Rebecca M. Lopez; Michael S. Ferrara; Kevin C. Miller; Francis O'Connor; Michael N. Sawka; Susan W. Yeargin Journal of Athletic Training 2015;50(9):000–000 doi: 10.4085/1062-6050-50-9-07 Emergency Preparedness in High School-Based Athletics: A Review of the Literature and Recommendations for Sport Health Professionals Olympia, RP ; Brady, J PHYSICIAN AND SPORTSMEDICINE Volume: 41; Issue: 2; Pages: 15-25 DOI: 10.3810/psm.2013.05.2008 MAY 2013 Policy Statement: Climatic Heat stress and exercising child and adolescent. American Academy of Pediatrics (Bergeron, Michael F; Devore, Cynthia; Rice, Stephen G) Journal of American Academy of Pediatrics 2011 128(3):e741 – e747 American College of Sports Medicine Roundtable on exertional heat stroke--return to duty/return to play: conference proceedings. American College of Sports Medicine (O'Connor, Francis G ; Casa, Douglas J; Bergeron, Michael F; Carter, Robert; Deuster, Patricia; Heled, Yuval; Kark, John; Leon, Lisa; McDermott, Brendon; O'Brien, Karen; Roberts, William O; Sawka, Michael) Current sports medicine reports 9.5: 314-321. (2010 Sep-Oct)	0	4

			American College of Sports Medicine position stand. Exertional heat illness during training and competition. American College of Sports Medicine (Armstrong, Lawrence E; Casa, Douglas J; Millard-Stafford, Mindy; Moran, Daniel S; Pyne, Scott W; Roberts, William O) Medicine and science in sports and exercise 39.3 (March 2007): 556-572. Drinking guidelines for exercise: What evidence is there that athletes should drink "as much as tolerable", "to replace the weight lost during exercise" or "ad libitum"? Noakes, T. D.JOURNAL OF SPORTS SCIENCES Volume: 25 Issue: 7 Pages: 781-796 ;2007 National Athletic Trainers' Association Position Statement: Exertional Heat Illnesses Helen M. Binkley; Joseph Beckett; Douglas J. Casa; Douglas M. Kleiner; Paul E. Plummer, Journal of Athletic Training 2002;37(3):329–343 Climatic heat stress and the exercising child and adolescent American Academy of Pediatrics (Anderson, SJ; Griesemer, BA; Johnson, MD; et al.) PEDIATRICS Volume: 106 Issue: 1 Pages: 158-159 JUL 2000 National Athletic Trainers Association Position Statement: Fluid replacement for athletes. National Athletic Trainers Association (Casa DJ, Armstrong LE, Hillman SK et al.) (2000) J Ath Train 35(2):212-224 Consensus recommendations on training and competing in the heat. Scandinavian Journal of Medicine & Science in Sports; S. Racinais, J. M. Alonso, A. J. Coutts, A. D. Flouris, O. Girard, J. González-Alonso, C. Hausswirth, O. Jay, J. K. W. Lee, N. Mitchell, G. P. Nassis, L. Nybo, B. M. Pluim, B. Roelands, M. N. Sawka, J. E. Wingo and J. D. Périard ; Volume 25, Issue Supplement S1, pages 6–19, June 2015; Br J Sports Med 2015;49:1164-1173 doi:10.1136/bjsports-2015-094915		
			Fluid and fuel intake during exercise Edward F Coyle Journal Of Sports Sciences Vol. 22 , Iss. 1,2004, Heat-related illness in athletes. Howe, Allyson S ; Boden, Barry P. The American journal of sports medicine 35.8 (August 2007): 1384-1395.		

Appendix N: Included Articles

Number	Title	Authors	Publication Date	Language	Time period of research	Country Of Publication	Proposed revision date
1	Policy Statement: Climatic Heat stress and exercising child and adolescent. Journal of American Academy of Pediatrics 128(3):e741 – e747	American Academy of Pediatrics (Bergeron, Michael F ; Devore, Cynthia; Rice, Stephen G)	2011	English (US)	Not indicated	USA	Not indicated
2	National Athletic Trainers' Association Position Statement: Exertional Heat Illnesses. Journal of athletic training 50.9 (September 2015): 986-1000.	National Athletic Trainers Association (Casa, Douglas J ; DeMartini, Julie K ; Bergeron, Michael F ; Csillan, Dave [4] ;Eichner, E Randy ; Lopez, Rebecca M , Ferrara, Michael S ; Miller, Kevin C ;O'Connor, Francis ; Sawka, Michael N ; Yeargin, Susan W)	2015	English (US)	Not indicated	USA	Not indicated
3	American College of Sports Medicine position stand. Exertional heat illness during training and competition. Medicine and science in sports and exercise 39.3 (March 2007): 556-572.	American College of Sports Medicine (Armstrong, Lawrence E; Casa, Douglas J; Millard-Stafford, Mindy; Moran, Daniel S; Pyne, Scott W; Roberts, William O)	2007(a)	English (US)	Not indicated	USA	Not indicated

4	Consensus recommendations on training and competing in the heat. Scandinavian Journal of Medicine & Science in Sports; Volume 25, Issue Supplement S1, pages 6–19, June 2015; Br J Sports Med 2015;49:1164-1173 doi:10.1136/bjsports-2015-094915	S. Racinais, J. M. Alonso, A. J. Coutts, A. D. Flouris, O. Girard, J. González-Alonso, C. Hausswirth, O. Jay, J. K. W. Lee, N. Mitchell, G. P. Nassis,L. Nybo, B. M. Pluim, B. Roelands, M. N. Sawka, J. E. Wingo and J. D. Périard	2015	English (UK)	Not indicated	UK	Not indicated
5	Heat-related illness in athletes. . The American journal of sports medicine 35.8 (August 2007): 1384-1395.	Howe, Allyson S ; Boden, Barry P	2007, Medline	English (US)	Not indicated	USA	Not indicated
6	Emergency Preparedness in High School-Based Athletics: A Review of the Literature and Recommendations for Sport Health Professionals PHYSICIAN AND SPORTSMEDICINE Volume: 41; Issue: 2; Pages: 15-25 DOI: 10.3810/psm.2013.05.2008 MAY 2013	Olympia, RP ; Brady, J	2013	English (US)	Not indicated	USA	Not indicated
7	Wilderness Medical Society Practice Guidelines for the Prevention and Treatment of Heat-Related Illness: 2014 Update Wilderness & Environmental Medicine, 2014-12-01,	Grant S. Lipman , Kurt P. Eifling, Mark A. Ellis , Flavio G. Gaudio , Edward M. Otten and Colin K. Grissom	2014	English (US)		USA	

	Volume 25, Issue 4, Pages S55-S65						
8	Exertional Heat Stroke: Strategies for Prevention and Treatment From the Sports Field to the Emergency Department Clinical Pediatric Emergency Medicine, 2013-12-01, Volume 14, Issue 4, Pages 267-278	Riana R. Pryor , Douglas J. Casa , Jolie C. Holschen , Francis G. O'Connor and Lesley W. Vandermark	2013	English (US)		USA	
9	National Athletic Trainers' Association position statement: preventing sudden death in sports. Athl Train. 2012 Jan-Feb;47(1):96-118.	National Athletic Trainer's Association (Casa DJ, Guskiewicz KM, Anderson SA, Courson RW, Heck JF, Jimenez CC, McDermott BP, Miller MG, Stearns RL)	2012	English (US)	Not indicated	USA	Not indicated
10	Inter-Association Task Force on Exertional Heat Illnesses Consensus Statement, www.nata.org/sites/default/files/inter-association-task-force-exertional-heat-illness.pdf	Oded Bar-Or, Cantrill, W. Larry Kenney, Suzanne Nelson Steen, Kim Fagan, Rick Wilkerson, Phillip Zinni III, N. Sawka C. Dexter (Bo) Kimsey, Jr, John W. Gardner, Bob Murray, Bareket Falk, Christine Bolger Douglas J. Casa, Chair Jon Almquist, Scott Anderson, Michelle A Cleary, Ron Courson, Robert L. Howard, Michael Ryan, Chris Troyanos, Katie Walsh, Maria Dastur, Michael Barnes, Terrence Lee;	2003	English (US)	Not indicated	USA	Not indicated

Appendix O: Dubai Health Authority Research Committee Ethics approval

GOVERNMENT OF DUBAI

DUBAI SCIENTIFIC RESEARCH ETHICS COMMITTEE APPROVAL LETTER

DUBAI HEALTH AUTHORITY

From :	Dubai Scientific Research Ethics Committee (DSREC), Dubai Health Authority	**Date :**	30 Sep 2015
To :	Mr. Andre Heynes, Physiotherapist, Physio Art Physiotherapy Center	**Ref :**	DSREC-09/2015_04
Study Site:	Various sports clubs, Dubai		

Subject: Approval for the research proposal: **"The vulnerability of adolescent sports participants in Dubai to exertional heat illness."**

Short Title: **Vulnerability to exertional heat illness in sporting adolescents in Dubai.**

Dear Mr. Andre Heynes,

Thank you for submitting the above mentioned research proposal to Dubai Scientific Research Ethics Committee, DHA. Dubai Scientific Research Ethics Committee has been organized and operates in accordance with the ICH/GCP guidelines.

Your request was discussed during the committee meeting held on 28 Sep 2015. We are pleased to advice you that the committee has granted ethical approval for the below mentioned documents:

Document	Version/Date
DHA Application form for Ethical Approval	-
Study proposal	V2.01, 01.03.2013
Synopsis of the study	
Resume of Principal Investigator	-

Appendix P: Stellenbosch University HREC ethics approval

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Approval Notice

Response to Modifications- (New Application)

24-Jun-2015
Heynes, Andre A

Ethics Reference #: S15/03/060

Title: The vulnerability of adolescent sports participants in Dubai to exertional heat illness.

Dear Mr Andre Heynes,

The **Response to Modifications** - ***(New Application)*** received on **18-Jun-2015**, was reviewed by members of **Health Research Ethics Committee 2** via Expedited review procedures on **22-Jun-2015** and was approved.
Please note the following information about your approved research protocol: Protocol

Approval Period: **24-Jun-2015 -24-Jun-2016**

Please remember to use your **protocol number** (**S15/03/060**) on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review:

Please note a template of the progress report is obtainable on www.sun.ac.za/rds and should be submitted to the Committee before the year has expired. The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.

Translation of the consent document to the language applicable to the study participants should be submitted.

Federal Wide Assurance Number: 00001372
Institutional Review Board (IRB) Number: IRB0005239

The Health Research Ethics Committee complies with the SA National Health Act No.61 2003 as it pertains to health research and the United States
Code of Federal Regulations Title 45 Part 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Contact persons are Ms Claudette Abrahams at Western
Cape Department of Health (healthres@pgwc.gov.za Tel: +27 21 483 9907) and Dr Helene Visser at City Health (Helene.Visser@capetown.gov.za Tel: +27 21 400 3981). Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.
For standard HREC forms and documents please visit: www.sun.ac.za/rds

If you have any questions or need further assistance, please contact the HREC office at 219389207.